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October 2, 1924

Engineering News-Record

Devoted to Civil Engineering and Contracting.
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Beginning in this issue:

A Series of Four Articles on

Winter Construction

As the Contractor Regards It

1: In this Issue

bor and Climate

rm and frost make work
e difficult but eagerness
employment raises the
ciency of the workmen

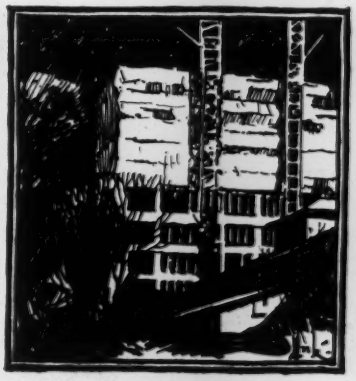
2: In Oct. 9 Issue

Processes and Plants

Changes in structural types and materials and improvement of construction equipment simplify winter work

3: In Oct. 16 Issue

Methods and Costs

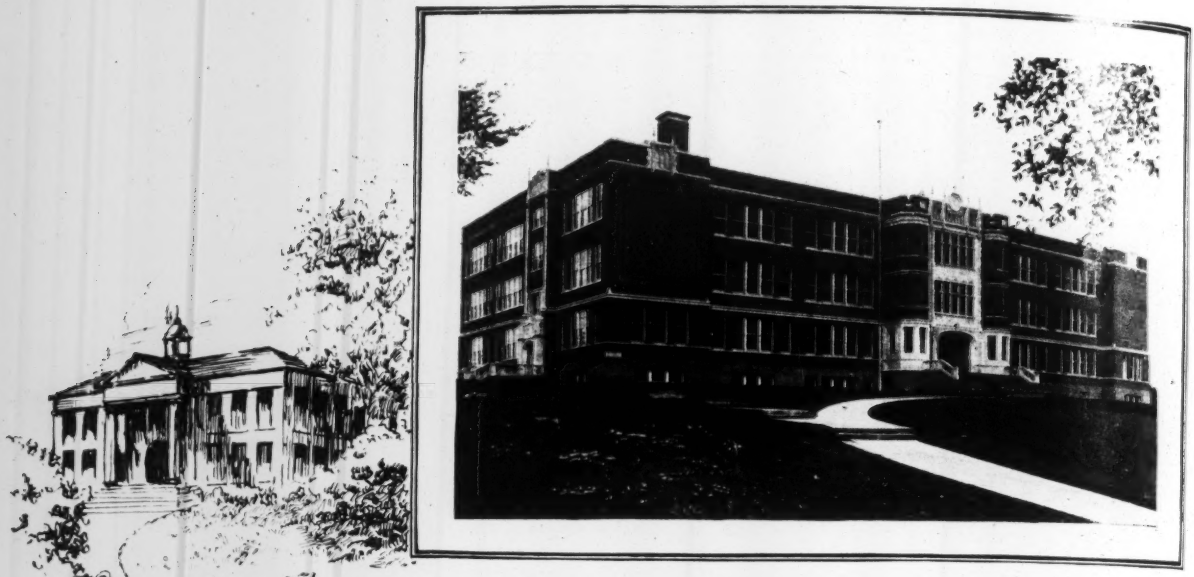


Skill and system in protecting construction from exposure have reduced direct winter costs to a low figure

4: In Oct. 23 Issue

Co-ordinate Services

Winter production and delivery of materials and full engineering co-operation essential to success



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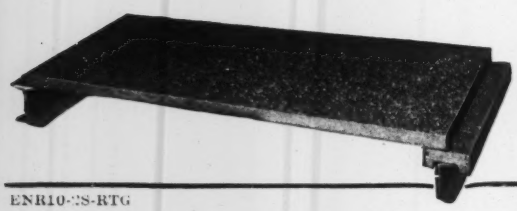

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 93 NEW YORK, OCTOBER 2, 1924 Number 14

For More Winter Work

THERE is no simple process of educating engineers, contractors and owners to the desirability of winter construction. It is easy enough to prove that year-round construction work is an economic gain, not only for those immediately benefited, that is the three interests noted above, but also to the world at large, which thereby has less waste of man power to contend with. But to get winter work done, to overcome the inertia of the past which has assumed that winter necessarily becomes a vacation time in construction is another and more difficult thing. The articles which begin in this issue are one of the many inciting forces which may start a winter work movement on its way. They discuss winter construction from the viewpoint of the most intimately concerned element, namely the contractor. They will not give the universal solution to the problem, but they do set forth the practical difficulties from the constructor's side, and if read carefully by other constructors will be found to contain the suggestions of methods and practices which can be used advantageously in selling the winter work idea.

About Bridge Railings

AMONG standing problems in bridge construction, railings are close rivals of expansion joints for the leading position in troublesomeness. How to build serviceable railings of attractive or even architectural appearance—combining strength, cheapness, convenience and good looks—has always perplexed engineers. But in these motor vehicle days more severe requirements than ever are imposed. Formerly the extreme condition as regards strength was the pressure of a packed crowd of spectators that might use the bridge as observation platform. The increased strength demands of today are illustrated anew by a recent occurrence in an Eastern city. A taxicab crossing a newly built bridge of monumental character skidded, climbed the curb, and knocked out a large section of the heavy concrete railing. Fortunately the cab did not follow the railing over the side, and in fact it suffered no damage from the collision, receiving not a mark except a few scrapes on its spare tire. The incident developed much public discussion, no doubt due as much to the surprising agility of the vehicle as to its destructive effect upon the bridge railing. Local comment reflects disappointment at the weakness of the railing construction; the bridge-using public evidently expects a bridge railing to be adequate for any demands, just as it expects the same of the bridge structure itself. It is probable that this is a general if not universal feeling, at least with respect to the heavy and costly balustrades that are usually provided on concrete bridges. If so, the engineer has no alternative but to supply the strength that his construction is expected to have. He may personally hold that when a taxi or a truck performs unconventional antics and runs into a railing it well deserves the hard fate of going over the side. But he cannot afford to build according to this belief unless it is endorsed by public sentiment. Designing collision-proof railings may be as difficult as designing impact-free expansion joints, but the difficulty is only the more reason why it should be done.

How Safeguard Harbor Oil Tanks

THE serious oil tank farm conflagration that occurred last week in Monterey, the picturesque old capital of California, reported elsewhere in the news columns this week, raises the question of the inadequacy of the precautions against the spread of such a fire. This particular "farm" was constructed years ago before the modern precaution of diking was in vogue and was therefore without that safeguard. As the burning liquid ran down to the sea the intense heat consumed everything in its path, even twisting the rails on the railroad and "eating up" asphalt paving. Out on the bay a veritable floating inferno formed as the burning oil spread rapidly over smooth waters. The lack of time and the risk of attempting to save the small fishing boats at anchor in the bay were such that they were left to their fate and burned like chips in a furnace. This incident may well serve to set port authorities thinking. How shall a column of fiercely blazing fire which floats on the tide be combatted? In waterfront fires at Seattle involving vegetable oil it has developed that oil burning on the water can be driven before the wind at considerable speed. It may be that the first necessity in combatting such fires would be some form of light non-inflammable floating barrier that could be towed like a log boom either to confine the spreading oil or, where it had already spread over a large area, to be laid as a protective barrier around wharves, thus preventing the approach of the floating menace. This whole subject of oil fires on the waterfront will bear more discussion and future meetings of port authorities might do well to give it further attention.

Changes in Rail Joint Practice

THE old controversy as to the respective merits of suspended and supported joints in railroad track seems likely to be disposed of by the growing tendency in maintenance practice to disregard the position of the joint in relation to that of the ties. This development is indicated by omission to spike the splice bars to the ties, by the introduction of joints which cannot be anchored in this way and by the objections of engineers to joints having parts which drop between the ties. Some new joints embodying the non-anchorage feature are described on another page. In maintenance and in rail renewals many railroads make no attempt to restore the original relations where rails or ties have shifted, or where the joints in the new rails do not match those of the old rails. In other words, the

ties and ballast are regarded as forming a substructure adequate to support the rails without reinforcement of the joints. This position applies particularly with modern heavy rails and splices which do not need to rely upon special tie spacing to minimize the deflection under load. In track laying, some specified arrangement of ties and rail joints is generally followed, but it is easy to foresee a further development in which the ties will be given a uniform spacing and the rails will be laid upon them without regard to whether the joints come on or between the ties.

Oh For a Business Man

THE business man versus engineer question, made somewhat notorious last year by Secretary of the Interior Work, has popped up again in New York State. One George Clinton, a canal booster by heredity and long practice, is chairman of a conference met to find out why the New York Barge Canal does not live up to the predictions of those who urged its construction twenty years ago, at a cost which has been nearly doubled in the actual building. This Mr. Clinton has discovered that the trouble with the canal is that its administration is in the hands of engineers rather than of business men. Whereupon the conference resolved to demand the repeal of the law consolidating the department of canals with those of highways and public buildings. Leaving aside any discussion of the abstract superiority of the business man as a public administrator, the facts in this particular case are that up to two years ago the New York canals were administered by the Superintendent of Public Works, that this official within memory has been a "business man" and that such small signs of life as the Barge Canal has shown have been evident since the law took the canal out of the hands of these "business men" and put them in the hands of the engineer. The New York canal has been such a load for the waterway enthusiast to carry, its performance has been so sad and its justification so doubtful, that one could pardon its defenders for almost any subterfuges. But why pick on the engineer?

The San Francisco "Gulf"

SAN FRANCISCO and the East Bay cities have thus far been wholly unable to come together in matters of municipal endeavor. Between the two there is indeed "a great gulf fixed," separating and estranging these neighbors who could work together to such good advantage, but whether due to a physical or to a mental barrier there is certainly notable absence of community interest. The aversion of Oakland merchants to a trans-bay bridge that would enable East Bay residents to shop in the larger city, competition in the matter of railway and water terminal shipping facilities and now the decision—subject to approval by popular vote—noted elsewhere in this issue, that East Bay cities should not participate with San Francisco in the Hetch Hetchy water supply, are all examples of the contending interests that have prevented the development of a unified metropolitan district around the greatest harbor on the Pacific Coast.

Conditions here are peculiar. Oakland has already grown independently to be a large city, thus making a joint government much harder to introduce now than it would have been years ago. Berkeley has been able, at least until recently, to keep its citizens quite generally interested in the city government; to a small neighborly community of this sort, nurtured by the cultural influence of a great university, the idea of bowing allegiance to the "domineering political influences" of the San Francisco city hall is most abhorrent. So with each of the other East Bay cities, of which nine are now combined in the East Bay Municipal District, there is no support for a plan to form a Greater San Francisco. The proponent of any such plan in the East Bay cities would be regarded as a traitor to his community and perhaps an agent of the scheming politicians of San Francisco reaching out for new fields. To sum up, San Francisco would consider advances looking to consolidation; the East Bay cities would not.

Whether this condition will change is hard to say. The typical California citizen is a vigorous courageous type; it would not be surprising if communities of such men and women on the east side of San Francisco Bay persisted in their decision to manage their own affairs. Considered solely from the viewpoint of the welfare and progress of California and the United States, it appears that the longer some co-operative plan is delayed the longer will the territory which the Federal Reserve Bank has already designated as Greater San Francisco fail to make the progress in finance, commerce and industry that would result from the hearty co-operation of the communities on both sides of the Bay of San Francisco.

There is no reason for taking the decision of the engineering board against participation in Hetch Hetchy as an evidence of animosity toward San Francisco. East Bay cities should and undoubtedly are trying to select the water supply which is best suited to their needs, all things considered. The incident simply calls attention to the lack of community interest among the San Francisco Bay cities. In view of the rapid progress and development of that region in recent years, it is interesting to consider what might be the result if there were a united, co-operative program for advance about which all of Greater San Francisco could be enthusiastic.

About Contract Surety Bonds

AT WHITE SULPHUR SPRINGS last week a group of surety men, contractors, and engineers got together to try to bring some order out of the growing confusion which attends the writing of corporate surety bonds for construction contracts. It was a small, if representative, group, and it had only advisory powers, so that what it did will have only initiatory effect, but its deliberations were significant, even more so perhaps than the formal results of the conference, printed on another page of this issue, might indicate. The frank expressions from the diverse gathering caused a wave which will extend out over the whole pool of interest; that is, the construction industry, and beyond that the taxpaying public.

For the contract bond situation is far from satisfactory. The surety bond primarily was devised as a protection to the public and private owner. It is insurance that the successful bidder will satisfactorily complete the desired work at the agreed price, a guarantee by some one obviously financially responsible of the financial responsibility of the contractor. It has

to be sure, certain advantages for the contractor himself, in that it permits him to undertake work which he would not otherwise be able to get and guarantees his credit from a single rather than from many sources. But in the main it is the owner who is most benefited, and it is the owner who pays the cost of the insurance in the long run. On the face of it, though, all parties ought to be satisfied; the owner gets protection, the contractor is helped to get a job, and the surety company makes a fair profit.

But none of these three parties is satisfied. The owner, be he private or public, objects that the charge for the service is too high and the guarantee against loss either of time or of money frequently illusory. The contractor complains that his responsibility is not fairly gaged by the surety nor recompensed in adjusting rates, and the irresponsible contractor thereby encouraged to the detriment of the industry. The surety company says that it is losing money and piling up difficulties in a thankless work. What is the way out? Shall the government undertake its contract insurance and leave the corporate surety business entirely to the private contract enterprises? Shall we encourage the individual personal surety or increase the partial payment holdback so that the holder is guaranteed of the completion of the work, or shall the various interests concerned try to look at the mistakes and evils in the business and try to reform it from within?

The answer of the conference was the latter, but the discussions and the reports of the committees show too well how long a pull there is ahead before reform can be accomplished. The deliberations of the conference make it clear that the major difficulty in surety bonding is irresponsibility of the principals. There are too many irresponsible contractors and there are too many irresponsible bonding companies. With the best intentions in the world the really responsible on either side cannot altogether eliminate the undesirables, but all of their efforts, as incorporated in their recommendations, are directed toward that end. The trouble now is that with all the talent and brains centered on the problem no one has come forward with a sovereign remedy.

The nearest approach is the central rating bureau, put forward tentatively in the report of Committee No. 1. Unfortunately this has never been suggested in any but a most nebulous form—an idea, only, of something approaching the long established mercantile bureaus which would be local, with a possible national headup, and which would in effect thoroughly investigate the financial and technical competence of every contractor and establish for each one a rating which the sureties would recognize. The advocates of such a bureau, however, have to admit that each surety company must reserve to itself the right to judge the competence of such a bureau's rating, which means of course that the surety may occasionally assume a risk against the nominal advice of the bureau, and thus destroy the very purpose for which the bureau would be formed, that is, to blacklist the irresponsible surety company. In other words such a bureau might accomplish the purpose of at least designating the irresponsible contractor but it would not necessarily keep him from getting a bond or keep the irresponsible surety from bonding him, and regardless of the effect of such a bureau, no one yet has suggested any detailed method of its management or offered any plan for its costly administration.

The other major suggestion which arose from the conference was the proposal from one of the surety men that there must be more co-ordination among the surety men themselves, that in each locality the representatives of the sureties must get together to exchange information, to study risks and to raise the standards of their own practice. In doing this they will not only become better qualified to judge risks but may slowly eliminate the unworthy surety. Minor reforms which promise relief are suggested in the reports. These include the elimination of the bid bond, that bait some sureties offer to any prospective bidder, regardless of his qualifications, in order to get his business; a suggestion for less free service by sureties to contractors; a standardization of application forms which will guarantee comparable statements of contractor's assets; and finally, a recommendation to the contractor to play fair in his statements so that the honest surety may be surer of just how great is its liability.

It should be clear from all this that the solution of the problem does not lie in any enforcible rules. It is a matter of slow progress and co-operative action. There is no easy criterion of responsibility in either contractor or surety. There is no way to eliminate the unworthy in either field except as the individuals eliminate themselves, as they surely do in time. But the prospects of profit in both contracting and insurance continually brings new men and companies into the field and these inexperienced elements cause most of the trouble. The tendency is for the experienced and honest on each side to discount the trouble that the inexperienced and dishonest cause the other side. This is particularly true, it would seem from the deliberations of the conference, of the surety companies. They are the least tolerant of reform and the more disposed to consider that they are doing the best they can under the circumstances. The contractors came to the table with certain statements of fact, controlling of which is the gradual governmental resentment against the whole practice of corporate surety bonding. The sureties, with few exceptions, met the situation with figurative shoulder shrugs and destructive criticism. For the most part they find it hard to conceive of contract insurance as anything but an individual business. They have a lot to learn in forwarding that co-operative effort which is the distinguishing feature of a profession as contrasted to a business, and which contracting, essentially a business, is just now beginning to learn.

The engineer, meanwhile, representing the owner, sees the damage to his principal from the unsettled state of contract insurance. He wants that principal guaranteed against violation or forfeiture of the contract he makes with the builder. He wants to know that the work will be carried on, not only in the time and at the cost contracted for, but within the necessary limits of technical quality. Especially if his principal is a government subdivision, forced by law to take the lowest responsible bidder, he views with alarm the more than occasional carelessness with which the surety guarantees responsibility. And he wants to see the practices of both contractor and surety in this matter of contract bond solicitation and writing improved. To that end he welcomes the efforts the joint conference has made, but, at the same time, he hopes that the matter will not be left, as it has indications of being now left, as a hopeless conglomeration of individual misdeeds, which cannot be cured by group influence.

Winter Construction

As the Contractor Regards It

1. LABOR AND CLIMATE

Storm and Frost Make Winter Work More Difficult, but Eagerness for Employment Raises the Efficiency of the Workmen.

The First of a Series of Four Articles

By C. S. HILL
Associate Editor, Engineering News-Record

Construction should be carried on throughout the winter season. That is the consensus of the thinking and study which have for the past few years been directed toward the waste of time and money in the construction industry due to the winter shut down. This study culminated in the report of the so-called Hoover Committee on Seasonal Construction embodied in the recently published book, "Seasonal Operation in the Construction Industries; The Facts and the Remedies" (McGraw-Hill Book Co., Inc., 1924). But the study has not fully covered one aspect of winter construction, the responsibilities and difficulties of the contractor, and that phase of the question is to be discussed in the following series of articles.

The contractor has a responsible relation quite different from the general interest of the economist. He is the workman who accomplishes the task in the cold, who guards and directs the laborers, who devises the special plant and methods and who takes the risk of delay, accident and failure. He is the technician of winter construction. Weather, labor, methods, plant, costs, transportation and materials supply are the factors with which he works. Broader questions of public policy, industrial economics, seasonal unemployment, finance and social betterment are left for the economist and the student of sociology. They are the contractor's problem only as they are the problem of all citizens.

It is proposed in the following discussion of winter work to speak specifically from the contractor's viewpoint. The subjects will be grouped under the following headings: (1) *Labor and Climate;* (2) *Processes and Plant;* (3) *Methods and Costs; and* (4) *Co-ordinate Services. Two years ago some of these subjects were considered in discussing lost time in construction* (Engineering News-Record, *Oct.* 5, 12, 19 *and* 26, 1922, *pp.* 548, 600, 644 *and* 696). *The present articles are a more complete development based on more extended experience and information.*

General knowledge of winter construction has increased in the last two years. The committee on seasonal construction has made its preliminary report. A number of Building Congresses have donated papers and data. Articles have appeared in the engineering journals describing specific operations. The Associated General Contractors through their committee on methods have contributed useful discussion. All these sources are drawn upon in this review and credit is here acknowledged. Chiefly, however, the writer has turned for understanding of the contractor's viewpoint of winter construction to the contractors themselves. Many have been interviewed and winter operations have been visited. The experience of Canadian contractors as well as that of contractors in the northern states has been sought.

There is a technique of winter work. Many contractors are familiar with it, and will attack construction in winter as confidently as in summer. But knowledge of that technique is not universal nor are all the difficulties and obligations of winter work always clearly understood. It is the purpose of these articles to collect experience of contractors and to make more general the facts and conditions which the contractor must face in winter work.—EDITOR.

LABOR is the critical element in the practical problem of winter construction. The designer of structures may have to consider the behavior of material in cold weather but the contractor who builds the structure is primarily concerned with the question of not merely whether men can work but also whether they will work, how efficient they will be and what the accident hazards are. Men can work in winter, as will be shown, at practically all construction operations. How much they will work, what is their output and their risk depends on weather severity, vocation, and prevalence of other less onerous means of employment. Let us examine the effect of these various factors.

Temperature and Weather—It is not temperature alone, but weather, which determines ability and willingness to work in winter. Thermometer records concern the contractor chiefly when cold is accompanied by wind, sleet, or snow. Other things being equal he finds it easier to get a full gang and a good day's work on a clear, calm, very cold day than on a warmer day with wind, sleet or snow. Eliminate the wind and precipitation factors and the contractor's cold weather construction problem can be very closely appraised. There are, however, influencing degrees of temperature.

Tables I and II are abbreviated and assembled from several tabulations in the Hoover committee report to exhibit (1) Influencing degrees of temperature; (2) geographical variations of influencing weather; (3) yearly variation of influencing weather, and (4) varying combinations of temperature and precipitation. No records are given of wind. The figures make it very clear that weather influences on winter construction are *variable in time and place.* They are of slighter interest as giving specific values. For direct service, contractors require analyses of local weather records in much more detail.

Trades and Operations—Weather has a varying influence according to trades and operations. These variations were discussed in the earlier series of lost-time articles and will only be summarized here. Considering the skilled trades—carpenters, masons, roofers and waterproofers, concrete finishers, lathers and plasterers, plumbers, electricians, etc.—it is roughly estimated by contractors that 50 per cent of the work is under shelter. This figure is based largely on experience in building construction where winter operations have made most progress and where shelter is comparatively easily secured. Steel workers are exposed. In other than building operations this is true also of form workers, masons and concrete workers. Machine

TABLE I—COMPARATIVE WEATHER CONDITIONS FOR NINE CITIES

All figures are ten-year averages expressed in days.

(Computation by Division of Building and Housing, Department of Commerce, from U. S. Weather Bureau Records.)

City	Number of working days on which work was probably stopped by precipitation (1) Nov. 1 to March 31			Number of working days, November to March, on which temperature fell below 32 deg. F. between 7 a.m. and 6 p.m.				Total cold or rainy working days Nov. 1-Mar. 31 (5)
	Apr. 1 to Oct. 31	Occurring on warm days	Occurring on freezing days	Total days per year	Class I (2)	Class II (3)	Class III (4)	Total Classes I, II, and III
St. Paul	3.45	0.50	0.00	3.95	58.6	19.9	27.4	105.9	106.40
Denver	1.90	0.10	0.65	2.65	24.7	21.8	37.1	83.6	83.70
Chicago	4.60	2.05	0.85	7.50	24.2	16.6	31.4	72.2	74.25
Boston	6.45	2.90	3.30	12.65	20.3	19.7	31.7	71.7	74.60
New York	5.60	3.60	3.90	13.10	14.3	16.2	33.4	63.9	67.50
St. Louis	5.75	3.50	1.85	11.10	14.9	12.0	29.3	56.2	59.70
Atlanta	6.35	5.35	0.15	11.85	1.7	4.9	15.4	22.0	27.35
New Orleans	4.95	4.70	0.00	9.65	0.0	0.2	1.7	1.9	6.60
San Francisco	0.80	5.40	0.00	6.20	0.0	0.0	0.0	0.0	5.40

(1) Precipitation: Rain, snow, or sleet of 0.05 inches and over per hour (water content).
(2) Class I (colder days): Days on which temperature fell below 18 deg. at some time, or did not rise above 24 deg. at any time.
(3) Class II (medium days): Lowest not below 18 deg., but temperature reached or exceeded 25 deg. during the day.
(4) Class III (warmer days): Lowest between 25 deg. and 32 deg.
(5) Total cold or rainy working days: November 1 to March 31. Sum of days in column 2 and column 8. The term "working days" includes all except Sundays and holidays.

operators, except drill runners, are sheltered. Common laborers generally work unsheltered.

Different operations afford differing degrees of shelter. Interior building operations are sheltered. Exterior wall masonry and steel erection are exposed but the former can be readily sheltered. Partial shelter is afforded in trenching operations and in deep foundation work; artificial shelter is comparatively easy to provide. Tunnel excavation is fully sheltered and open pit and cut excavation is exposed. Road construction; formwork and framing; concreting except building and sub-surface work; hauling and handling materials, generally, are exposed operations. The degree to which winter work can be prosecuted depends a great deal upon the relative percentage of favorable and unfavorable sub-operations.

Courtesy Thompson-Starrett Co.

CLOSE UP OF BRICKLAYERS' ENCLOSED SCAFFOLD

Photograph taken in January

Storm and Frost Effect—Only very broad generalizations are possible in appraising the effect of cold and storm on construction operations. The possible combinations of temperature, wind, sleet and snow are too numerous and the sensitiveness of different operations to storm and frost is too variable to permit definite values to be laid down. In every case the contractor has to interpret effects *in the light of his particular operation and the local winter weather conditions.* It is for this reason that he needs, as stated previously, local winter weather records in detail. The following generalizations are based on the temperature classifications of Tables I and II.

Both the efficiency and hazard of workmen are influenced as will be more fully discussed in succeeding paragraphs. In general also it may be concluded that storm, with cold, has far greater influence than does cold alone. In respect to temperature the Hoover committee concludes that "some care has to be exercised during the Class III cold days in the erection of exposed masonry and concrete, particularly in thin forms. The efficiency of most work on outdoor jobs is not much affected by days in this class in which the temperature at any time during the working day does not go below 25 deg. The second class of cold days, which is relatively small, would begin to interfere with the efficiency of work in exposed places, particularly if there is a wind, though a day in which the temperature is around 20 to 24 deg. in the early morning may turn out to be very mild. Rather more protection of mortar or concrete is required. Most of Class I days interfere to a certain extent with outdoor work, although heavy timber and bridgework, mass concrete below grade, certain kinds of excavation, piling and other jobs can be carried on with reasonable efficiency."

These are reasonable conclusions considering temperature alone. Practically, the degree of interference of cold of various intensities is largely modified by special equipment and processes and experienced management. As an example, regard the number of cold days in New York in ten years as given in Tables I and II. Statistics of actual lost time for virtually the

TABLE II—WEATHER CONDITIONS AFFECTING OUTDOOR CONSTRUCTION, NEW YORK, N. Y., 1913–1923

Number of working days on which temperature fell below 32 deg. F. between 7 a.m. and 6 p.m.

(Computation by Division of Building and Housing, Department of Commerce, from U. S. Weather Bureau Records.)

Winter	Class I days (1)	Class II days (2)	Class III days (3)	Total cold days	Wet days
1913–1914	17	14	32	63	10.5
1914–1915	7	18	42	67	14.0
1915–1916	17	18	42	77	15.0
1916–1917	13	21	28	62	19.0
1917–1918	26	25	25	76	11.0
1918–1919	4	9	32	45	12.0
1919–1920	23	17	40	80	18.5
1920–1921	7	6	29	42	10.0
1921–1922	12	13	37	62	14.0
1922–1923	17	21	27	65	7.5
Average	14.3	16.2	33.4	63.9	13.1

(1) Class I (colder days): Days on which temperature fell below 18 deg. at some time, or did not rise above 24 deg. at any time.
(2) Class II (medium days): Lowest not below 18 deg., but temperature reached or exceeded 25 deg. during the day.
(3) Class III (warmer days): Lowest between 25 deg. and 32 deg.

same period compiled by the George A. Fuller Co., building contractors, show that construction was virtually impossible due to temperature on 14 days each year. Commenting on this figure, J. Reid Fitzpatrick, vice-president, said: "It is necessary to consider figures for rather extended periods because one job, or two jobs or three jobs running one, two or three years give a result which might mislead one in appraising general conditions. The periods, in the ten years, for which work was interrupted run 5 to 31 days a year."

While the facts as given of climate influences on construction trades and operations are perhaps only such as could be inferred they have been mentioned thus at length to emphasize the very important truths that as the contractor regards winter construction:

1. There is no general winter construction condition; instead every operation has its individual winter construction conditions determined by the reactions between several factors.

2. Weather interference with construction in winter is modified by the availability of special equipment, processes, structural types, construction materials and protective measures.

3. Successful winter construction technique (the contractor's function) involves scheduling job operations and co-ordinating extra-job services so as to minimize on the operation as a whole the handicapping effect of weather on any individual craft.

Courtesy Thompson-Starrett Co.

MASONS BRICKING-IN A BUILDING IN NEW YORK

The safety scaffold is covered with canvas, salamanders are spaced at intervals and work continues despite near-zero March weather.

Winter Labor Efficiency—Extremes of temperature and storm affect the efficiency of workmen. The degree in which winter weather affects labor varies with the severity of the weather and with the operation, as has been stated, but in general all manual operations are less deft, tools and materials are less tractable in manipulation, footing is slippery, the men are bundled up and hear, see and move less quickly. Considering

ON A POWER JOB WHERE ZERO WEATHER IS MILD

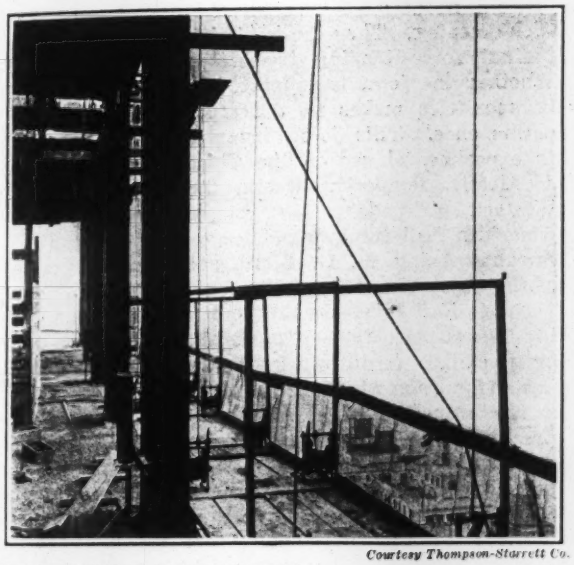
For the job of an inspector or if no great physical energy is expended, great coats, often of fur, are required. Laborers, too, must don an uncomfortable number of garments.

the labor force as a whole, efficiency is decreased in another manner—full gangs are more difficult to maintain. The sting of frost, sleet and wind, the fear of illness from cold and wet, influence men to stay at home on bad days and to hunt the occasional jobs which give shelter and warmth. Hot weather is no such deterrent to continuous labor; it does not at its rare extremes in climates where winter work is a practical question, reduce individual efficiency as does bitter cold and wind. With all this truth of fact and logic of argument, however, records of winter construction confront us with the fact that labor productivity is greater in winter and labor costs are less per unit of construction. Let us consider first the records.

Direct comparison in units of output between winter and summer labor is very nearly impossible. Records are lacking. In all that has been said of winter labor in the last two years the writer has found only one definite figure. In a talk before the New York Building Congress John Lowry, Jr., building contractor, referring to a specific $750,000 building operation, said: "Taking as a base the production per day of a bricklayer in the summer of 1922 at 100 per cent, it was found from actual figures that the production in the winter of 1922-23 was 109½ per cent, that is, the bricklayers laid 9½ per cent more brick in the winter than in the previous summer, on a similar job. In the summer of 1923, when bricklayers were scarcer than in 1922, production dropped to 91 per cent of the 1922 figure."

While short on actual figures, contractors on the other hand seem ready to make an off-hand estimate whenever requested. The writer has perhaps a score of them. They range from minus 15 per cent to plus 15 per cent and are so erratic and in some cases so manifestly mere guesses that they are of no value. Apparently from the report of the Hoover committee its experience with contractors' estimates is scarcely more favorable.

On the basis of labor unit costs the records are available for somewhat more complete comparison. In the report of the Hoover committee Sanford E. Thompson gives four tables comparing labor productivity in summer and winter. A summary of the percentages, of the cases cited, shows an average of about 15 per cent saving in brick masonry labor. This saving is shown by the decrease in labor costs from standard. There is a somewhat less saving in reinforcing labor, which averages about 6 per cent saving, and of concrete labor, averaging 11 per cent saving on the jobs cited. Form labor is apt to cost slightly more (8 per cent increase in the cases given) in the winter.



Courtesy Thompson-Starrett Co.

BRICKLAYERS' SCAFFOLDING ON BUILDING WORK

Showing angle-iron frame on which canvas was stretched during winter. This photograph was taken May 28, 1924.

Mr. Thompson states, "These averages indicate the cost of all labor, except form construction, to be lower in winter than in summer. The figures may be considered as representative since they are compiled from the records of several large contracting firms in New York and Boston, who have the reputation of close estimating and accurate cost keeping. They are selected as cases of summer and winter construction possessing the greatest construction similarities, and arranged in groups to equalize outside conditions as nearly as possible."

Explanation of this commonly greater output of labor in the bad weather season of the year is given by practically all, who offer the evidence, as follows:

1. In the winter owing to the general slacking down of construction there is a surplus of workmen while in summer with construction at its seasonal peak there is a shortage.

2. Because of winter idleness the common labor wage scale is less and skilled labor can be had at union wages whereas in summer a bonus commonly has to be paid.

3. Because of lack of employment in winter all workmen, to hold their jobs, work harder and faster.

This explanation deserves close consideration. The physical conditions of winter work are more difficult but employment conditions are so much more favorable in winter that they overcome the handicaps of cold weather. As the contractor regards winter work these truths are significant:

1. As the practice of winter construction grows, toward a full twelve-months construction year, the employment curve will approximate a level line instead of showing the present summer peak and winter valley. Co-ordinately the wage curve will straighten out at a level below the present summer peak but also well above the present winter valley. Correspondingly the labor efficiency curve will lose its present winter peak but probably also will rise above its present summer valley. Therefore, as the contractor regards the situation, he cannot expect a continuation, as winter construction increases, of the slump in wages and the jump in efficiency which now enable him to show lower labor costs on winter operations.

2. The surplus of labor under present conditions, even in the cold winter zones, is not uniform over the country. The Hoover committee report indicates this condition clearly. (1) In certain cities and regions winter construction has already become common and the wages and efficiency curves are straightening out locally. (2) In other localities opportunity to get other work in winter is offered construction laborers and there is no extensive unemployment. Under these conditions again the contractor takes an individual view of winter construction. With him construction is not a generalization. It is always a specific local problem. In the locality and for the particular operation he may or he may not be in position to get increased labor productivity in winter. He must plan and estimate according to the conditions, not according to national graphs of labor supply and weather conditions.

Winter Labor Hazard—Legislation and custom today make the contractor the guardian of the safety of his workmen. He is financially responsible for accidents. Hazard, therefore, is a liability and must be appraised according to the conditions. Frost and storm increase hazard. How much? Here again we are confronted with lack of data and diversity of opinion. We have then to fall back on general reasoning.

Snow and ice make a slippery footing. Tools are cold and slippery. Explosives have to be thawed. Wind and snow reduce vision and drown other sounds. The men are bundled up and less quick to see and hear and get out of the way of trains and other moving loads. In extreme cold, below zero temperature, Canadian contractors assert that there is greater breakage of tools, wire rope and steel derrick parts. All these conditions increase the theoretical hazard of winter work. On the other hand keen consciousness by the workmen of this hazard may increase caution or the contractor may employ extra safety measures which may overcome the extra hazard. The point is to be observed that all these things are factors for consideration in the contractor's problem of winter construction. This conforms to the broad conclusion which follows from a consideration of weather and labor influences in winter construction.

As they affect construction weather and labor are local conditions modified by the character of the operation. Their influence has to be determined for each operation separately. The things most wanted at the present time for this determination are recorded data of experience. Winter construction is a separate problem for every job.

Rail Joint Designs Presenting New Features

Separate Wearing Plates—Plain Bars with Joints Not Anchored to Ties—Bars Without Top Contact—Hinge Joint

ALTHOUGH rail joints are universally of the spliced type, there are numerous variations in detail, while new designs or modifications continue to be presented. It is of particular interest to note that of five rail joints now in experimental service, as described below, four recognize the growing tendency to avoid holding the joint in place upon the ties and to disregard its position in relation to the tie spacing. Furthermore, three of them use plain bars instead of angle bars and one is designed to act as a hinge.

In ordinary practice angle splice bars are secured to the ties by spikes driven in holes or notches in the bars,

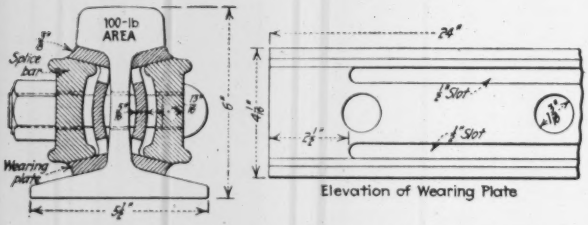


FIG. 1—HYLE RAIL JOINT WITH WEAR PLATES

in order to resist creeping or longitudinal movement of the rails. But it is becoming more general to avoid this form of anchorage, leaving the joint to perform only its purpose as a splice and using suitable independent devices for anchoring the rails where necessary. According to this later practice, therefore, it is a matter of no concern whether joints occur over or between the ties. In this way, the ties are not shifted from their well-tamped seats in the ballast by creeping of the rails, while track maintenance is freed from the laborious and costly work of shifting ties to conform to shifted joints or to the new positions of joints in rail renewals.

Hyle Rail Joint—The special feature in this joint, Fig. 1, which is spliced with fish plates instead of angle bars, is the use of channel-shaped wearing plates fitted between the contact surfaces of the rails and splice bars and so arranged as to provide wedge action for taking up wear. A wider contact area on the rail is thus provided, and after the surfaces have become worn only the wedge or wearing plates need to be renewed. One purpose of the design is to maintain a tight joint without using extra material. Thus the material in bars and wearing members is no greater than in an angle bar joint of equivalent strength, while the taking up of vibration in the spring action of the wear member is said to make it unnecessary to use spring washers or nutlocks to keep the bolts tight. This member is so shaped that when drawn up into position the convex form of its web exerts a horizontal spring action, keeping the bolts in tension.

Since the wearing member has its flanges normally steeper than the fishing angle, it is sprung into place and has an initial vertical pressure which automatically will take up any slack due to wear under the rail head until the bolts are tightened to wedge the splice bars tighter into position. At first the wear takes place directly at the ends of the rails, and can be compensated for by tightening the inner bolts. As the wear extends farther along the joint, the outer bolts also will be tightened. To assist this vertical action, the wearing member is slotted along the top and bottom of the web for the greater part of its length. Both the wearing members and the splice bars are 24 in. long; the former are drilled like the rail with four $1\frac{3}{16}$-in. holes, while the latter have holes alternately $1\frac{3}{16}$ in. and $1\frac{1}{8}$x$1\frac{3}{8}$ in., for bolts 6 in. c. to c.

No attempt is made to anchor the joint to the ties, but it is free to move if the rails should creep; suitable rail anchors are used where it is necessary to stop such creeping. Thus the joint ties are free from longitudinal force tending to shift them from position. Whether the joint is supported on a tie or suspended between ties makes no difference in its strength or permanence. This joint, invented by J. A. Hyle, is in experimental use on the Chicago & Alton, Boston & Albany, Pennsylvania and Denver & Rio Grande Western railroads. It is being introduced by the American Rail Joint Co., Chicago, the president of the company being W. G. Bierd, receiver and president of the Chicago & Alton R.R.

Neafie Rail Joint—In this joint also there is a return to the fish-plate type of splice, but with heavy plates or splice bars reinforced by top and bottom ribs, forming an I-section which can be reversed to take up wear, as shown in Fig. 2. A feature in this design, as in the preceding one, is to free the joint from its use as an anchorage on the ties. The joint is of the base supported type, having the rail ends seated on a base plate 27 in. long and resting on the two joint ties. But the position of the joint on the plate is immaterial.

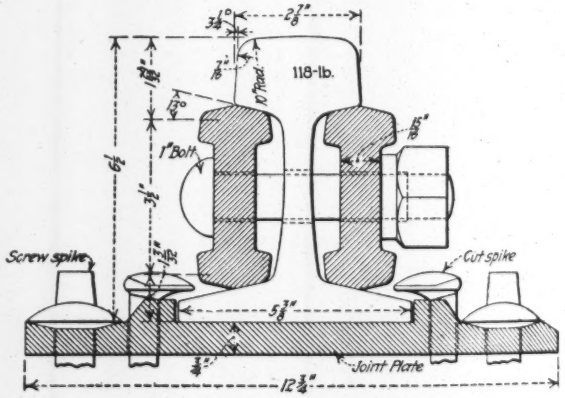


FIG. 2—NEAFIE JOINT WITH REVERSIBLE BARS

Normally, with new track, it would be at the middle of the plate. If the rails creep, so that the joint comes directly over a tie, the strength of the joint is not affected. Should the creeping continue until the joint has passed off the base plate, the tie-plate on the shoulder tie in advance would be taken out and the joint plate shifted forward one tie space, the tie-plate being then replaced on the former joint tie in the rear. In this way the joint may be maintained without any shifting or respacing of the ties, either accidentally by the creep of the rail or purposely to adjust tie positions to the joint position. There are six bolts with a spacing of $4\frac{3}{4}$ in., except that the central spacing is $4\frac{1}{8}$ in.

The base plate has two ribs or shoulders which fit the width of rail base and thus prevent lateral motion of the rails. It is secured to each tie by four screw spikes, but the rail is held by two cut spikes which are driven in such position that the shoulder of the plate keeps the spikes about $\frac{1}{8}$ in. clear of the rail base, thus allowing for the vertical wave motion of the rail under traffic. With the base support, stiff bars and six closely spaced bolts there should be little deflection, but if the bars should become bent they can be reversed or inverted. Furthermore, if there should be excessive wear of the contact surfaces, the bars can be turned so that the former outside ribs become the fishing portions. This joint, which has given good results in experimental service on 118-lb. rails, is the design of A. J.

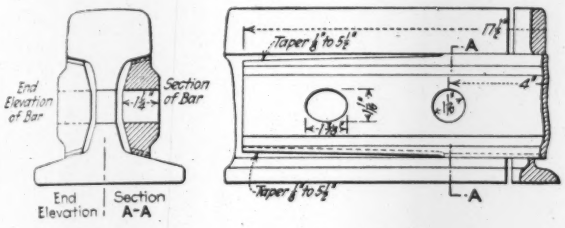


FIG. 3—ROACH HINGE JOINT

Neafie, principal assistant engineer of the Delaware, Lackawanna & Western R.R.

Roach Bar Joint—The purpose in this design, shown by Fig. 3, is to form practically a hinge, so as to offer no interruption or obstruction to the wave motion of the rail under traffic and thus to retain the full strength at the ends of the rails. As in the two preceding designs this joint uses plain bars instead of angle bars and makes the location of the rail joint independent of the position of the ties. To allow for the hinge action, the contact surfaces of the splice bars with the top and bottom fishing surfaces of the rails are only 4 in. long; beyond these bearings the 17½-in. bars are tapered on top and bottom at ¼ in. per foot to the ends, so as to be clear of the rail head and base. This arrangement allows the rails to have free vertical movement in the joint but prevents any such movement of one rail end relative to the other. It is the idea that by this arrangement the wheel load is applied only at the middle of the joint and thence distributed to and through the four bolts instead of beginning when the wheel is back of the end of the bars. The bolts are spaced 4 in. c. to c.

In order to act as a hinged splice, the outer bolts draw the ends of the bars into close contact with the rail web. This lateral bending also affords resistance to lateral blows on the rail, which resistance is claimed to be more effective than that of the flange of an angle bar. With this construction also, the bars act under shearing stress both vertically and laterally, and their bending moment is practically a negligible factor in relation to strength of joint. The stress on the bolts is said to be only about one-eighth of that of joints in which the bars bear on the head and base of the rail for their entire length. No base support is used, except where the joint happens to come on a tie. As in the preceding designs, whether the joint is supported on a tie or suspended between ties is immaterial so far as its strength and action are concerned. Joints of this type, invented by H. F. Roach, Reinforced Rail Joint Co., St. Louis, Mo., have been in experimental use in main track of the St. Louis Southwestern Ry. for about five years without requiring to have the bolts tightened or track surfaced, although the track carries 220-ton locomotives with 56,800-lb. axle loads.

Head-Free Joint—An unusual feature in this joint is that the splice bars have no contact with the underside of the rail head, or what is normally the fishing surface, the upper part of each bar being shaped so as to take its bearing only at the rail fillet, as shown in Fig. 4. Nor is there the usual wedging action, as the bars cannot be moved inward beyond the position taken when they are first applied. Consequently, it is only necessary to have the bolts tight enough to hold the parts together and there is less liability of track men screwing the bolts so tight as to restrict expansion movement of the rails in an attempt to tighten the joint. Since the rail head is unsupported for its entire length, it is not subjected to anvil action at the ends under blows exerted by the wheels or due to the counterbalances in driving wheels. Deflection is said to be less than in the ordinary type of joint, while there is greater resistance to lateral thrust, as on curves, since the top of the splice bar has a direct bearing against the rail web.

This joint, which is a development of the Continuous joint now in extensive use, is of the base-supported type, the angle splice bars being made to fit under the base of the rail, but the extreme edges of the base are free, in order to avoid pinching and possible fracture. The joints now in use on 130-lb. rails have bars 24 in.

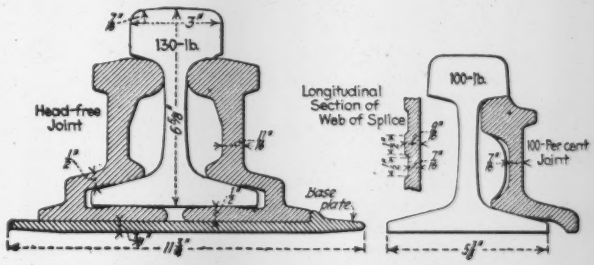


FIG. 4—HEAD-FREE JOINT (LEFT) AND 100-PER CENT JOINT (RIGHT)

long, with four bolts. The splice bars rest on tie-plates which are spiked to the joint ties and prevent wear or cutting of the wood by the movement of the joint under traffic. The joint has been in experimental use for two or three years on both new and old rails, being considered specially suitable for the latter, since it has not to be adjusted to the worn fishing surfaces. It is being introduced by the Rail Joint Co., New York.

The 100-Per-Cent Joint—Although this angle-bar splice, also shown in Fig. 4, is a modification of an earlier design, it is noted here as another indication of the trend of railway engineers to dissociate the rail from its supports. In the original "100-per cent" joint the bars were of Z-section, additional stiffness being obtained by a short vertical web depending below the flange and fitting between the ties. In view of the objections to parts below the ties, this joint has been modified by its maker, the Rail Joint Co., the bottom web being omitted and the bar reinforced by a heavy rib on the top and by vertical ribs on the inner side of the bar.

Activated-Sludge Process Has Come to Stay

Impressions of American Engineer after Visit to England and Talks with British Engineers—Air Economy Being Studied but Sludge Dewatering and Utilization Neglected

By T. Chalkley Hatton
Chief Engineer, Sewerage Commission of Milwaukee, Wis.

THOSE CONCERNED with sewage treatment may be interested in a brief summary of the notes taken by the writer during a short tour of inspection of some of the important sewage-works in Central England, which he has just completed after attending the interesting and instructive International Conference of Sanitary Engineers held in London last July.

Activated-Sludge Process—Of the four days during which the conference lasted, the most interesting and best attended was the day devoted exclusively to the papers and discussions relating to the activated-sludge process. This was probably due to the rapidly increasing interest in this subject throughout the several countries represented at the conference, and especially in England where it has taken root as no other sewage-disposal process has within a like period. We, in America, are conducting experiments on this process at a few places while in England experiments are being conducted at nearly all the larger sewage-works and at many smaller ones. The character of the experiments differs considerably but for the most part their aim appears to be a reduction of the volume of air required for aeration, and thus of power cost. To this end several different appliances have been and are being used.

The reason for increased use of this process in England is apparent. Because of density of population and absence of large water courses, England is full of sewage-works. Every small town has its plant. Many of these plants have been overworked for years, and during the five years of war but little was done toward enlarging them. Now, when materials, labor and some money are available, there is a pressure to extend the works as rapidly as possible and with the least expense.

Large Investments in Older Processes—Many millions of dollars have been expended in all parts of England for contact beds or trickling filters working at rates of approximately 0.6 m.g.d. per acre of beds 5 ft. deep. (Imperial gallons are used throughout this article; add 20 per cent to convert to American gallons.) It appears to the engineer like folly to scrap all this capital cost. There is not sufficient money available to extend the works on present lines to meet the requirements, so at many important plants the activated-sludge process has been adopted as a preliminary treatment for the sewage whereby its organic matter is so much reduced that the contact beds or trickling filters can treat from three to four times as much activated-sludge effluent as they can of effluent from sedimentation tanks. The cost of installing an activated-sludge plant is less than that of providing additional contact beds or sprinkling filters. In addition to this, many smaller municipalities are scrapping much of their present plant and are building complete new works of the activated-sludge type, reserving for the moment only that portion of the old works devoted to sedimentation tanks and sludge disposal.

Air Reduction the Aim—As stated, the engineers appear to be devoting most of their efforts to schemes for reducing the volume of air required. To this end several methods are being tried out among which may be mentioned the reduction of air diffuser surface to tank surface, and increase in air velocity, with the idea that only sufficient air is required to keep the sewage in circulation while in the aerating tanks. By this method, the diffusers are placed on one side of the bottom of the aeration tanks parallel with the axes of the tanks, baffles being placed across the tanks at intervals of 18 to 25 ft. to prevent short circuiting.

Surface Contact Aeration by Paddle Wheels—The method brought out by Haworth of Sheffield depends upon oxidation or aeration by surface contact only. This he effects by means of 8- to 10-ft. paddle wheels revolving at an average rate of 15 r.p.m., thus creating a decided wave action and a velocity of some 1.5 ft. per second through the sewage channels, which are about 6 ft. wide and 4 ft. 5 in. deep. There are 20 of these channels, in each of which a wheel is placed. The sewage flows through each one until it has traveled 5,540 ft. when the aerated sewage, containing the flocculated sludge, flows over a weir into hopper-bottom sedimentation tanks where the sludge settles and is returned in the proper quantities to the middle of the first aeration tank.

Aeration by Revolving Disk Acting Through Cylinder—Another method of surface contact, used in several places, is effected by the Ames Crosta aerator which consists of a 6- to 8-ft. disk with vanes attached to the upper surface and radiating from the central vertical shaft, the whole supported by a truss thrown across the top of the tank. The wheel is submerged a few inches below the surface of the sewage, over a cylinder which extends to a few inches above the bottom of the tank. The wheel revolves at a speed of about 30 r.p.m., throwing the liquid outward and breaking it up into streams. The displacement thus afforded creates a current upward through the cylinder and throughout the whole tank.

A method which is being tried at Bradford centers in the diffusers, which are of porous concrete tile, the aggregate being roofing slag or stone passing a ¼-in. mesh. The bottom and sides are made practically airtight by a coating of cement. The top, for a width of 2 in. and for the full length of the tile, is unplastered and quite porous. The tiles, which are flat-bottomed, 5 in. in diameter and 2 ft. long, are placed across the aeration tanks, 4 ft. apart, and through them is run a wrought-iron air pipe with ¼-in. perforations every 4 ft. Each end of the tile is plugged after the air pipe is placed. The air is broken up into small bubbles (⅛ in.) by passing through the top of the tiles and from appearances the diffusion was excellent. The advantages claimed for this diffuser are its small cost (about 2c. per square foot of tank surface), facility of renewal and small friction losses.

Comparative Results—Two tanks of the same capacity were being worked side by side—one with the

porous tile diffusers, and one with an aerator consisting of a shaft supported across the aeration tank at intervals of about 26 ft. Radiating from this shaft, and attached thereto, are iron pipes 8 ft. long with the outer end open. As the shaft revolves at approximately 10 r.p.m. the pipe arms pass through the sewage disturbing its surface by splashing thoroughly, thereby inducing surface contact. The percentage of purification effected was 75 to 25 respectively, the former using 24 B.hp. per million Imperial gallons of sewage treated and the ltter, 19 B.hp. The equipment cost of the concrete diffuser is about one-eighth that of the Ames Crosta aerator.

Each of the various methods of aeration inspected had its advantages and each produced, ordinarily, a clear effluent but there was a lack of flexibility in all except the concrete-tile method. This was well illustrated in three plants visited where a very poor effluent was being obtained, the operators not being able to account for it. When the writer suggested that more air was required, the answer was that this could only be obtained by cutting down the volume of sewage being treated.

In none of these methods has study been given to the effect upon sludge dewatering of cutting aeration to a minimum. In fact, very little scientific study has been devoted to the sludge problem and yet it is recognized by the English engineer that the success of the activated-sludge process is dependent upon the final dewatering of the enormous volume of very liquid sludge produced.

Preliminary Treatment—In no place visited were fine screens used, but in nearly all places there were coarse screens, sedimentation tanks and equalizing tanks, each of the tanks providing for a 6- to 12-hour detention period. The equalizing tanks were used to produce a sewage throughout the day of uniform character and were introduced to help the contact beds or trickling filters over peak loads of industrial sewage. Usually 50 per cent or more of the suspended and settleable solids was retained in these tanks.

Huge Expenditures—In view of the money shortage in England and the high taxes, it is surprising to learn of the vast sums being expended on new sewage-works or additions to old ones. These sums are far greater than American cities will spend for such purposes. For instance, Reading, England, with a population of 93,000, producing 3 m.g.d. of sewage, is expending $363,000, or about $121,000 per million gallons of sewage treated. (Imperial gallons 20 per cent larger than American, as noted before.) Sheffield, treating 15 m.g.d. is expending for new works $2,000,000. Salford treating 17 m.g.d., is expending for additional works $2,400,000. Bury, treating 4 m.g.d., is expending for additional works $250,000. Bolton also treating 4 m.g.d., is expending nearly $500,000. Bradford, treating 17 m.g.d., is expending $12,000,000 for new works, and Leeds, which will treat 22 m.g.d. is spending $8,000,000 in addition to several millions already expended on the old works. The same is true of operating costs. Birmingham, for instance, treating about 37 m.g.d., employs 250 men; Bradford, 300 to 350 men, and Leeds 79 men, and the smaller works employ men in like proportion.

Sludge Disposal Neglected—That which most seriously impressed the writer during his tour of English sewage-works and talks with English engineers was the lack of intelligent and scientific study of the sludge problem. For 60 years, English engineers have been studying sewage treatment and have led the world in its development but they have apparently failed to grasp the idea that the treatment of sewage is not complete until the resulting sludge is disposed of in a sanitary manner which will best add to the welfare of mankind.

This sludge has always been a dirty mess around the average English sewage-works and the community has, with an unexplainable complacency, tolerated it. Hundreds, and in some instances thousands, of acres of good arable lands in close proximity to large cities have been devoted exclusively to the final disposition of sludge, the fertilizing value of which has been utterly wasted in a land where such values are of especial significance.

Plant Food in Sludge Wasted—The writer, in traveling through central England, saw thousands upon thousands of acres of lands uncultivated because of the fact that for generations everything had been taken from the soil and no plant food returned until the land could not be cultivated with profit, and much of this land was in close proximity to sludge beds containing much valuable plant food going to waste because it appeared to those in authority unprofitable to reduce it to such a condition as to make it attractive to the agriculturalist.

Lloyd George stated publicly a few days ago that until the Englishman produced more food from his arable lands and decreased the $1,800,000,000 annually expended for food importations, he could not hope to compete with the world economically. My answer would be that if he utilized the enormous amount of plant food now wasted in his sewage sludge he could make much of his waste land arable and thus reduce this expenditure substantially, and I believe it is the engineer's work to reduce sewage sludge to a marketable condition and to educate the consumer in its use. The cost of reducing the sludge to a marketable condition may be greater than the price received for it, but its ultimate value in increased food production per acre of land tilled will be ample compensation in a compact, little island like England.

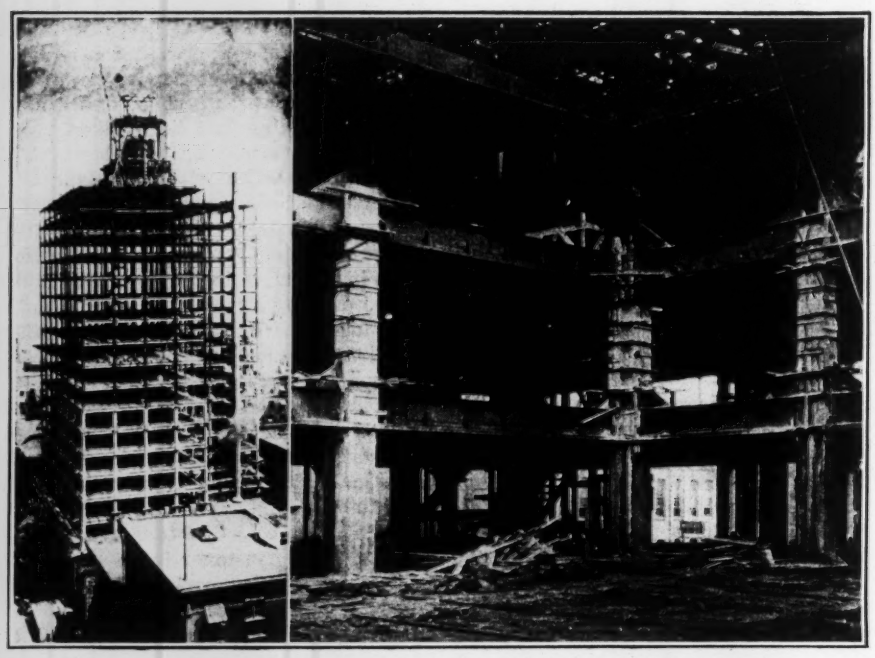
Another phase of this sludge muddle struck the writer forcibly. The hundreds of acres devoted to sludge disposal are always close to cities. In many places the cities have extended around them. As long as these acres are used for sludge disposal they cannot be used for the much more valuable purposes of residence and industrial properties, and thus the taxable values of the cities are reduced. If a survey were intelligently made, it would be found that this is a very considerable loss to the communities.

Activated-Sludge Process Come to Stay—Reverting, in conclusion, to the activated-sludge process: It has come to stay, both in England and in America. While it is not a panacea in sewage treatment, and will not completely displace other processes, it will doubtless be adopted more generally than any other, as is being demonstrated now throughout England. Therefore, improvements in the process are bound to be rapid and are desirable but the most serious study and investigation must be carried out on the lines of sludge disposal, and the writer hopes that our English friends will give us their help in this respect, as they have heretofore helped us in the other branches of the art.

Measured Stresses in Columns of 18-Story Building

Strain-gage Readings Taken During Erection Show Close Check with Computed Loads and Moderate Bending Effects

AN EXTENSIVE series of strain-gage measurements of the dead-load stresses in the steel framework of a tall building was carried out in Des Moines, Iowa, during the past year. The test work and its results are described by Prof. Almon H. Fuller in Bulletin 71 of the Engineering Experiment Station of Iowa State College, shortly to be issued. The following brief abstract is taken from a manuscript copy of this bulletin.



FIGS. 1 AND 2—FRAMEWORK OF BUILDING DURING CONSTRUCTION

Two views of the steel frame of the Equitable Life Insurance Co. of Iowa Building, Figs. 1 and 2, and the typical floor framing plan, Fig. 3, show the character of the structure upon which the measurements were made. The building was designed by Proudfoot, Bird & Rawson, architects, and Harry Hartupee, structural engineer, and was built by the A. H. Newmann Co., contractors. The structure is eighteen stories high in its main portion but has an 85-ft. tower in its central part, making the total height to top of tower 310 ft. It has brick walls and flat-arch tile floors. The building was erected during the summer of 1923, and the strain-gage readings were taken in the period from June to October, with one series of readings on one member three months later.

Measurements were made on four columns, at three cross-sections in each, namely just above the basement floor, below the first-floor beams, and above the first-floor beams. The locations are indicated in Fig. 3. Column 6 is a normal interior column. Column 5 is an exterior column above the third floor. Column 20 above the third floor is at the corner of a re-entrant angle on the southwesterly side of the building. Columns 20 and 28 are alongside an elevator shaft and extend to the top of the tower. The columns are built I-section; their makeup is given in Table I. At each measurement point sixteen gage lines were established; three on each flange plate (middle and both edges), one on each corner of each angle, and one at the middle of the web on either side. When readings were taken, the loads in the building were computed by the observers and the results checked against the records of the structural engineer. At each observation, repeat readings on each gage line were taken; the plotted points given in Figs. 4 and 5 represent in each case the average of several (usually three) readings.

All readings were made by comparison with a standard bar. Laboratory determination of the expansion coefficient of this bar, after the close of the work, showed a slightly greater coefficient than that of structural steel, tending to make the observed compression greater than the actual. This effect was equivalent to a stress of about 500 lb. per square inch at the highest load on the columns. Apart from these effects, the precision of the strain-gage work is believed to be such that the results are correct within 1,000 lb. per square inch, while the estimates of load which were made at each observation are believed to be correct within 5 per cent.

The columns under test were subject to bending action from the beam connections. Columns 20 to 28 were also subject to bending moments from the attachment of the derricks, and Column 5 from a bracket connection for a heavy smokestack which was built at the first floor level.

The results of the observations are summarized in

TABLE I—MAKE-UP AND SECTION OF COLUMNS

	Sectional area, square inches
Column 5	
4 angles 6 x 4 x ⅝	27.76
1 web plate 13 x ¾	9.75
2 cover plates 14 x 1	49.00
Total gross area	86.51
Column 6	
4 angles 6 x 4 x ⅝	27.76
1 web plate 12 x ½	7.50
2 cover plates 14 x 1½	52.50
Total gross area	87.76
Column 20	
4 angles 6 x 6 x ¾	38.92
2 web plates 13 x ½	16.25
1 cover plate 16 x 2½	34.00
1 cover plate 24 x 2½	63.00
Total gross area	152.17
Column 28	
4 angles 6 x 4 x ¾	31.92
2 web plates 12 x ½	15.00
2 cover plates 16 x 2½	88.00
Total gross area	134.92

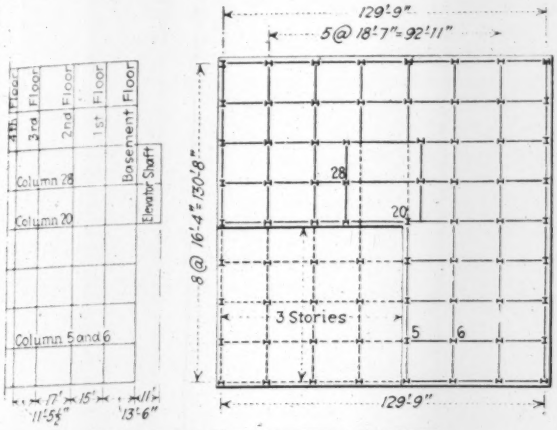


FIG. 3—PLAN OF STEEL FRAMING

Table II, which gives for each section of each column the load and the observed mean stress, both in pounds per square inch. Representative curves of column stress plotted on load are given in Fig. 4. These show a very satisfactory character of the measurements as judged by proportionality of stress to applied load. They also give information about the variation of stress over the cross-section of the column, not given in the table. This stress variation is shown in another form of plotting in the diagrams of Fig. 5, given for two of the columns.

The largest variation of stress occurred at the base (section *A*) of column 5, where the mean observed stress was 10,000 lb. per square inch and the maximum and minimum stresses in the cross-section were 6,700 and 14,900, indicating a bending stress equal to about 50 per cent of the direct stress. This bending is not considered chargeable to the smokestack bracket at the first floor level, because no marked bending is observable at sections *B* and *C* of the same column (in Fig. 5). It is considered more probable that the bending is due to imperfect bearing of the base of the column, section *A* being just above the base.

The bulletin draws attention to the fact that the wide plates on column 20, which have the purpose of resisting wind stresses, project so far beyond the last row of rivets that concerted action of the outstanding parts of the plates with the body of the column cannot be expected; this is considered to explain the peaks in the distribution diagrams, Fig. 5, for points 1 and 3.

Marked bending at section *C* of column 28 is considered to be due to the bending effect of a large girder connected at the first floor level. Readings on this girder during the early part of the erection work indicated considerable bending in the girder, especially at the end connecting to column 28. It was estimated

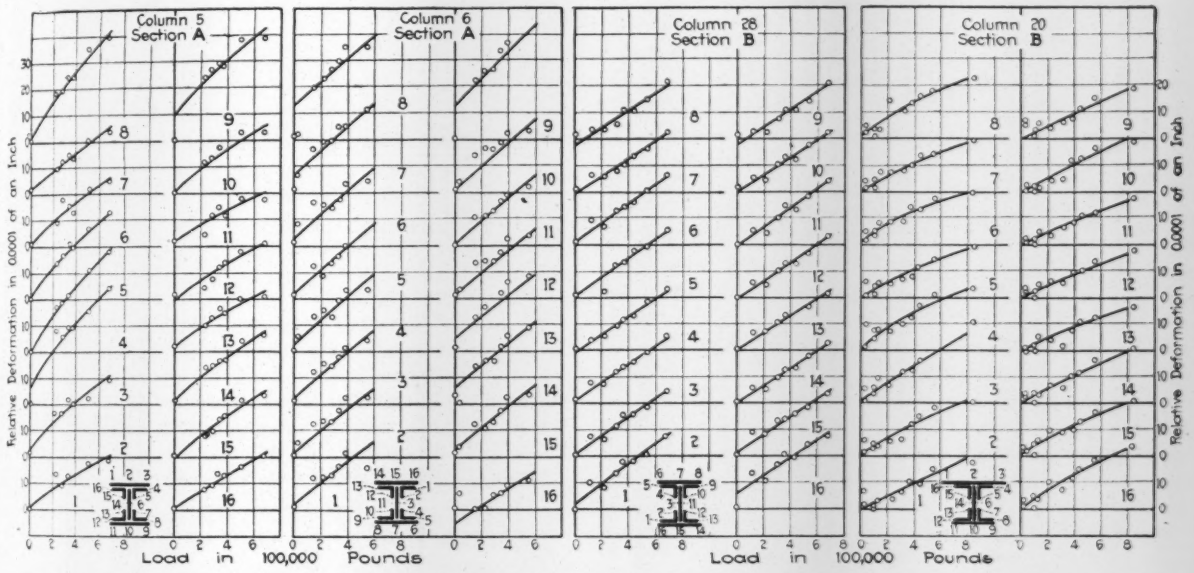

Column 5 Section A
Column 6 Section A
Column 28 Section B
Column 20 Section B
Relative Deformation in 0.0001 of an Inch
Load in 100,000 Pounds

FIG. 4—RELATION OF MEASURED STRESSES TO LOAD FOR FOUR COLUMNS AT UNDERSIDE OF FIRST FLOOR LEVEL

TABLE II—OBSERVED AND COMPUTED COLUMN LOADS
(In pounds per square inch)

Col	Total Load, lb.	Section A Obs.	Section A Comp.	Section B Obs.	Section B Comp.	Section C Obs.	Section C Comp.	Section D Obs.	Section D Comp.	Average Difference
5	700,000	10,000	8,100	10,300	8,050	8,500	7,840	....	....	1,600
6	600,000	9,300	6,840	9,100	6,760	9,300	6,570	....	....	2,600
20	800,000			7,200	5,250	7,300	5,220	6,600	5,100	1,800
28	600,000			7,300	4,450	7,400	4,420	6,800	4,330	2,700

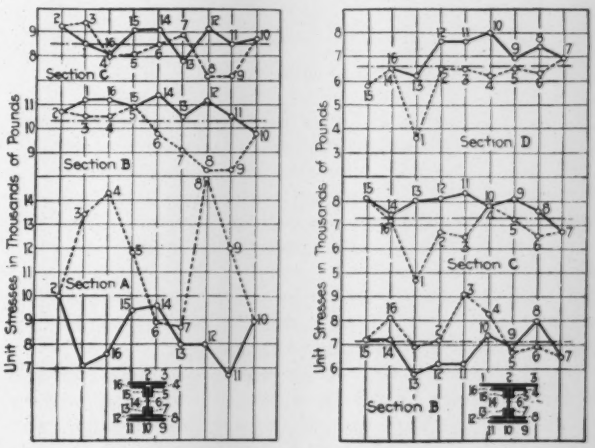


FIG. 5—STRESS DISTRIBUTION IN TWO OF THE COLUMNS AT THREE DIFFERENT CROSS-SECTIONS

that this bending might transmit a load of 3,000 to 5,000 lb. to the column. While this amount is a very small fraction of the column load, if a similar effect took place at each of the twenty-two girders and all the lighter beams framed to the column, a considerable excess of column stress over ideal load might occur.

An attempt was made after the close of the work to check the elevations of the columns with a view to detecting any foundation settlement that might have occurred during the erection. The foundations are concrete piles. It was not possible to obtain such check, however, as all points on which earlier levels had been taken were covered by the basement floor.

The work was planned by W. R. Stegenga, graduate assistant at Iowa State College, and Orville P. Upp, instructor. Most of the observation work was carried out by the former. Prof. A. H. Fuller and Prof. H. A. Caughey directed and advised in the work.

Floods in Southern Part of India Do Excessive Damage

By E. W. T. Slater
Hassan, Mysore State, India

INNUMERABLE engineering works have been subjected to a strain never before known in South India, during the recent floods when the River Cauvery and its tributaries overflowed their banks and covered large areas of land. The bridges over these rivers were severely tested, and scores of them, of all sizes, have been washed away or damaged. There are large parts of the country that are cut off from the rest, and many

FLOOD WATERS TOP KRISHNARAJA SAGARA DAM

months will elapse before communications can be re-established. Several of the bridges were old structures, with fifteen to twenty spans, while others were more modern. All have suffered severely. Hundreds of miles of railway lines have been washed away, and the cost of reconstruction will be very high indeed. In some places the rivers rose 30 ft. higher than in the normal period, and hundreds of thousands of houses have been washed away. It is estimated that nearly a million people are homeless through this calamity.

In the south there are several large dams, and the authorities have been in considerable anxiety regarding them. Periyar dam, one of the highest in India, was reported as breached, but it was later found that no serious harm had resulted from the flood. The largest dam of all, the Krishnaraja Sagara dam in the Mysore State, is still unfinished, and as the waters rose steadily fears were entertained as to its stability. On one day there was no less than 18 ft. of water flowing over the top of the dam itself, forming a veritable Niagara. Thousands of people came to see the falls, special trains being run from distant places. But fortunately for the dam the river had also carved out for itself a great overflow channel and the water rushed down this passage like a mighty cataract. The accompanying pictures give some idea of the overflow at this important dam, which is now nearly 100 ft. high. For several days the road leading to the dam was covered, and work

NEW CHANNEL CUT BELOW KRISHNARAJA SAGARA DAM

had to be suspended. A large number of anicuts have been broken, and as a result, many of the irrigation channels have been destroyed. Several million dollars will be required to make repairs on these channels.

In South India, in Mysore, and in other parts of India, relief funds have been opened with a view to meeting the immediate needs of the thousands who have suffered. Though the loss to property is so enormous the number of lives lost is comparatively small. There are signs of further heavy rains which will greatly hamper the reconstruction work already begun.

British Railway Adopts 20-Ton Coal Cars

The extensive introduction of 20-ton coal cars by the Great Western Ry., England, and the offer of a rebate of 5 per cent of the freight rate for coal handled entirely over its road in fully loaded 20-ton cars, marks an important development in British railway practice, since both package and bulk freight are commonly handled in 10- and 12-ton cars. Larger cars, even up to 40 tons, have been used experimentally or to a limited extent, but the Great Western Ry. is putting into service 1,000 of the 20-ton cars, exclusive of 2,000 similar cars used for handling its own locomotive coal. A 50-car train is about 1,225 ft. long, as against 1,010 ft. for a similar train of 10-ton cars with only half the load. The new cars are of steel, with two drop doors for side discharge and with ends hinged at the top for end discharge on car dumpers or tilting tables at shipping docks. The body is 21½x8 ft. and 4 ft. 9½ in. deep, with a length of 24½ ft. over the spring buffers. Each car is mounted on four 38-in. wheels with a wheel-base of 12 ft. and has four-wheel hand brakes operated from the ground by a lever on each side. For a load of 44,800 lb. the dead weight is 21,280 lb.

Notes from Foreign Fields

Economic and Technical Work of the League of Nations

By E. J. Mehren
Vice-President, McGraw-Hill Co., Inc.

"THE LEAGUE of Nations issue is dead,"—such has been the pronouncement of a goodly number of American politicians. Some have even declared that the League *itself* is dead, or have interpreted America's abstention as an omen of early demise.

This week I spent two days in the Palais de Nations, the headquarters of the League in Geneva; and I can say with emphasis: "The League is not dead. Indeed, it is very much alive." It may not be fully competent yet to deal with crises of the magnitude that followed the assassination of the Austrian archduke in 1914; it may never reach such competence, but it is a going organization, remarkably staffed for service between the nations and, following the Treaty of Versailles, an absolutely necessary instrument for restoring the economic functioning of Europe.

This is not the place to speak of the political mission of the League; there are other publications that adequately deal with this element of its work. But there are economic and educational functions regarding which the engineer, the industrial leader, the man who wants to know what the world is doing, should be informed. It is these functions, and their commercial and economic effects, that will be discussed here.

Extra-Political Activities—That the League should have such functions is obvious on a moment's reflections. The world today is a collection of producing units bound together by an elaborate network of commercial ties. Back and forth over the borders go the goods of one country in exchange for those of another, creating an economic dependence that, when disturbed, upsets the whole social organism. After the disruption, statesmen can throw down new boundaries almost at will, but the results will be chaotic until the experts in finance, communication and transportation, readjust the services and the mechanism cut asunder by the new lines.

An example will help to clarify this statement. Under the Treaty, the determination of the sovereignty of Upper Silesia was left to a plebiscite. The results of the vote and its interpretation by the Council of the League were similar to what we should have if a north and south line were to be drawn just east of Pittsburgh as the boundary between two new nations. In Silesia the railroads were cut in most confusing fashion, mines in Poland had their shafts in Germany, railroad engine facilities were cut off from the lines served, the car supply was in a hopeless muddle.

The Communications and Transit Section of the League, consisting of engineers and railroad operators, was directed to straighten out the tangle. So well did it succeed that the economic life of Upper Silesia, though necessarily hampered, is now proceeding in an orderly fashion.

Economic Functions—The economic and technical functions of the League are administered chiefly by the following sections: 1. Financial and Economic; 2. Transit; 3. Health; 4. Intellectual Co-operation.

The International Labor Office, erected under the Treaty, is an autonomous body and has its own organization, though its budget is subject to the control of the League. It works, of course, in harmony with the League and there is, where desirable, interchange of experts.

In the dramatic character of accomplishment the work of the Financial and Economic Section easily occupies first place. Austria came to the League a bankrupt and was put on its feet. Hungary is working under a somewhat similar rehabilitation plan, with Jeremiah Smith, Jr., of Boston, acting as Commissioner-General of the League. A half million Greek refugees from Turkey are being settled on land under a plan, involving a large and difficult financing feature, worked out by this section. Danzig has been given a new currency, settling an almost impossible problem for this "free city," surrounded by Polish territory.

These are outstanding accomplishments, regarding which, particularly the Austrian rehabilitation, there have properly been many admirable articles in American general magazines. However, there is much additional work under way: on the equitable treatment of commerce passing between nations, on suppression of unfair competition, on fair treatment of nationals of one country established commercially in another, on simplification of customs and other formalities affecting commerce, on arbitration of international commercial disputes, on unification of laws relating to bills of exchange, on uniform methods of presenting statistics and index figures, and on similar international economic and commercial problems.

Transit Section—An example of the Transit Section's work has been given; it is typical of the special questions put before the section. There is, in addition, a long list of subjects involving day to day operation of means of communication on which the committee is working, all looking to the facilitation of transit between states. Much, of course, has been done in this direction by international conference and agreement before the war, such agreements as the Stresa convention on technical uniformity (standardization of gages, clearances, equipment, etc.), and the Berne convention covering international bills of lading. The section begins its work where such conventions leave off. The extension, for example, of the use of a through bill of lading and of standard contract provisions in the bill to shipments originating in, destined for, or passing through all continents as well as Europe, is being sought by the League. Of course, in Russia and the United States the League has no government support—a bar to the world-wide extension of any uniform practice that may be adopted.

In the two General Conferences held under the auspices of the section since its formation steps have been taken in the formulation of recommendations and conventions (proposed international agreements) covering, among other things, the following matters:

1. Removal of obstacles to the free passage of goods in transit through a country, involving the granting of complete equality in shipment between foreign and domestic goods. (This is a subject of very special concern to landlocked nations, Austria, Hungary, Switzerland and Czechoslovakia.)
2. Principles regarding transportation and rights of use on "waterways of international concern," that is, waterways which provide access to the sea for more than one nation.

3. A standard statute of port regulations.
4. Uniformity of tonnage measurement in maritime navigation.
5. A long series of problems involved in rail communication between countries covering such points as: (a) Agreements on through service; (b) unification of frontier stations; (c) mutual use of rolling stock; (d) regulations regarding tariffs that will facilitate international traffic; (e) financial arrangements between railway administrations.

Conventions have also been drawn up on the transmission from country to country of electric power and for agreements between nations for the development of hydraulic power.

Health Section—Of high interest, also, and of great international value, is the work of the Health Section. Its function can well be imagined by recalling the epidemics which have struck Europe since the war and realizing the need of dealing with them competently, if their spread was to be prevented. In fact, the section grew out of the organization (the Epidemic Commission) quickly formed after the Armistice to aid the countries bordering Russia to stop the ravages of typhus.

The need for its work becomes the more important when the weakened condition of the peoples of Europe, due to malnutrition, is considered, as well as the lowering of standards in public health control, inevitable under war stress and organization of new nations.

It is natural, therefore, that the Health Section should have attacked the whole problem of public health administration and epidemic control in a very broad way. In addition, therefore, to most effective work in fighting epidemics in Russia, in the Russian border states and among the Greek refugees returning from Turkey—all of this in co-operation with the governments of these countries, and, in fact, largely as an adviser to and organizer of the country's own medical and sanitary forces—the section has become a vast information center on epidemic control and public health administration. Besides the typhus studies, inquiries have been made or are under way, among other subjects, into the causes of epidemics in the Eastern Mediterranean, into sleeping sickness and tuberculosis in Africa, into the health problems (largely related to epidemic control) in Far-Eastern ports, into cancer mortality and the indications of available cancer statistics, into methods of combating malaria, into port sanitation, and into the production and standardization of serums.

An important feature of its work is the study, by international groups of physicians, sanitarians, and public-health officers, of public health administration in different countries. Groups have already been taken to Belgium, Italy, England, Austria, and the United States (to the latter in the autumn of 1923). Special groups to study malarial control in Italy and to confer on bacteriological laboratory problems have also been brought together.

The countries to be visited by groups this year were Holland, Denmark, and Switzerland, with a special group for the Far East. The groups differ for each visit, the purpose being to spread, as widely as possible, a knowledge of good practice. In the visit to the United States the group comprised twenty-four health officers from fourteen countries.

This exchange of public-health personnel, as well as other work of the section, has been very materially aided by contributions from the International Health Board of the Rockefeller Foundation.

"Intellectual Co-operation"—The final extra-political phase of the League's work that has general interest is less tangible than those already described. It deals with "intellectual co-operation," and has as its purpose the development of contacts between thinkers and writers of all countries to the end that while "avoiding interference with the way each country expresses its own national genius" this will make it easier to draw upon the "common fund of knowledge, methods and discoveries." The section aims to work with all international bodies now functioning along these lines. Its program, as so far developed, includes these items:

1. Institution of a general inquiry into the conditions of intellectual life. (This study is already far advanced.)
2. Examination of the problem of assistance to nations whose intellectual life is especially endangered. (As a result of this work, much help has already been extended to Austria.)
3. Study of questions of intellectual property. (This includes inquiries into: (a) The possibility of securing for the discoverer some return from the practical benefits that may flow from the discovery of a scientific law or the property of a body; (b) copyright law; (c) "continuous rights," reserving to artists a certain percentage of the proceeds of the continued sale of their work, and a moral right to object to their alteration or mutilation; (d) creation of a kind of state copyright, after the expiration of the ordinary copyright, the proceeds to go to the support of national or international institutes; (e) protection of university and professional degrees.
4. Study of university co-operation.
5. Study of bibliographical questions, library co-operation and international agreements regarding the exchange of publications of every kind.
6. International co-operation in archæological research. (This involves: (a) listing sites not yet explored, (b) development of a general plan of research, (c) agreement on methods of research, and (d) international rules for preserving archæological monuments and establishing rights of property therein.)

The work of the section is in its infancy, but the strength of its appeal was shown in the demand at the last meeting of the League Assembly for representation on the directing committee of the section of every national culture not then having representation. An American, Dr. George E. Hale, director of the Mt. Wilson Observatory and chairman of our National Research Council, was a member of this committee at its establishment. Upon his resignation on account of ill health, he was succeeded by Dr. R. A. Millikan, formerly of the University of Chicago and now of the California Institute of Technology (Norman Bridge Laboratory of Physics). The other members of the committee are of correspondingly high attainments.

International Labor Office—One other agency needs mention to complete the picture of the international economic and technical organizations centering at Geneva, namely, the International Labor Office. Its func-

tion is to gather information regarding labor conditions and, in conference, to develop out of this information recommendations and proposed laws. In the six conferences already held a variety of recommendations and measures have been adopted relating to such matters as hours of employment, night work by women, employment of minors, protection of workers in hazardous employment, employment at sea, use of white lead paint, and collecting of statistics regarding unemployment, emigration and immigration.

The theory of this office's work seems to be that workers are necessarily in international competition and that in fairness to them the conditions under which they work should be made uniform. The exact text of the Treaty of Versailles, setting up the Labor Office, is worthy of reading, particularly as it is said to be the first mention of the rights of labor in an international treaty:

"*Whereas*, the League of Nations has for its object the establishment of universal peace, and such a peace can be established only if it is based upon social justice;

"*And, whereas*, conditions of labor exist involving such injustice, hardship and privation to large numbers of people as to produce unrest so great that the peace and harmony of the world are imperiled; and an improvement of those conditions is urgently required; as, for example, by the regulation of the hours of work, including the establishment of a maximum working day and week, the regulation of the labor supply, the prevention of unemployment, the provision of an adequate living wage, the protection of the worker against sickness, disease and injury arising out of his employment, the protection of children, young persons and women, provision for old age and injury, protection of the interests of workers when employed in countries other than their own, recognition of the principle of freedom of association, the organization of vocational and technical education and other measures;

"*Whereas*, also the failure of any nation to adopt humane conditions of labor is an obstacle in the way of other nations which desire to improve the conditions in their own countries;

"The High Contracting Parties, moved by sentiments of justice and humanity as well as by the desire to secure the permanent peace of the world, agree to the following: . . ."

There is, obviously, room for study and discussion regarding the economics of this procedure of leveling up employment conditions in all countries—a statement here made without prejudice and indicative of a desirable line of inquiry which, unfortunately, the writer was unable to pursue. It is sought, for example, to bring all nations to the 8-hr. day. Is that a desirable movement, when differences of climatic, living and social conditions are considered? The question certainly deserves discussion.

On the other hand, some of the conclusions of this office, as represented in the agreements it has drawn up and recommended for legislative enactment to the member countries, will have general approval. Such matters are the prohibition of night work by women and of employment of young children in industry, and the adoption of sanitary codes for the protection of the health of industrial workers.

It is interesting to note that both employers and employees are represented in the General Conference, at which the recommendations and agreements are discussed and adopted. The constitution gives to each member country four delegates, two representing the government, one the employees and one the employers.

A staff of 300 members has been developed at Geneva and is engaged in accumulating the data upon which the General Conference predicates to work. Already, there have been 129 ratifications by member countries of agreements approved by the General Conference and these agreements now form part of the laws of the respective countries.

So far the results of the office's work have been the more effective in countries which are backward industrially and in labor legislation. It has borne an important part, through its recommendations and draft conventions, in the new Indian factory act, in new labor legislation in Japan, and in the beginnings of labor legislation in China. It is thus helping to bring conditions of labor in the more backward countries up to those which obtain in countries farther advanced, and thus to mitigate the competition to which the laborer of higher standards is subjected.

Government Backing—This, then, will show briefly that the League of Nations is not solely a political institution. It has technical, economic, and educational functions of widespread influence. Whatever may be its strength as a political agency, it is a boon to the whole world, and to Europe in particular, for the extra-political work it is carrying on. It reminds one of the centralizing agency that is constituted by every national government, carrying on for the good of every section of its territory activities that necessarily transcend district borders. In Washington, for example, we have the Department of Commerce, the Public Health Service, the Bureau of Education, and similar agencies. Geneva is likewise a centering ground of activities, of activities that transcend, not domestic, but international borders. Its influence is wide, for a map with the member countries marked in black shows white only at the United States and Mexico, in the New World, and Germany and Russia, in the Old.

Moreover, these extra-political activities of the League are much more effective than would be international co-operation by economists, technicians and educators without official standing. There was a great deal of such unofficial co-operation before the war but much of it was ineffective.

We, of the United States, of course, have no *official* connections with the League's work, but the extent to which Americans as individuals have participated is astonishing. Americans are represented in nearly every important extra-political activity of the League and in many of the political ones. In all, 115 Americans have served on committees, have been present as "official observers" at conferences or have worked in the headquarters office at Geneva. As Dr. Manley D. Hudson, of Harvard, has said, "The United States is not *in* the League, but it is necessarily of it. The Government has not become a *member*, but scores of Americans have *joined*."

As its activities expand, our interest in its extra-political as well as its political functions is bound to increase. As Basil Miles, of the International Chamber of Commerce, has well said, "We can keep out of European politics. We can not keep out of European business."

Geneva, August 8.

One of a Series of Articles on the Details of Design and Layout of Different Types of Industrial Buildings

New Lime-Burning Plant of Union Carbide Company

Explosive Qualities of Pulverized Coal Dictated Dust-Proof Partitions and Dust-Tight Coolers and Dryers—Zinc Roof Insulated from Steel Purlins

BY H. L. NOYES
Chief Engineer, Union Carbide Co., Niagara Falls, N. Y.

FOUNDATIONS to support 250-ton rotary lime-burning kilns, dust-proof partitions, a zinc roof insulated from the steel purlins, welded coolers and dryers to prevent explosions from coal dust leakage, utilization of waste heat and a single stack instead of one for each kiln are some of the features of the new lime-burning plant of the Union Carbide Co., at Sault Ste. Marie, Mich.

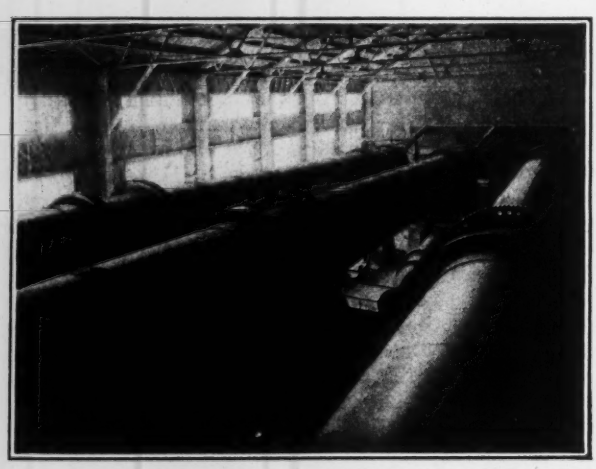


FIG. 1—ROTARY LIME-BURNING KILNS FROM FEED END
Steel building with corrugated metal sidewalls and zinc roof and dust-proof partition of plastered metal lath. Welded kiln on right.

In 1922 the company decided to replace its old lime-burning plant with rotary kilns fired by pulverized coal. All improvements were incorporated which had suggested themselves as the result of experience gained with plants at Niagara Falls, N. Y., and Welland, Ontario. The new rotary kilns replace a battery of sixteen vertical kilns erected in 1903 and succeeding years. These old kilns were fired with producer gas and were fed with man-size stone. The determining feature in selecting rotary kilns for the new installation was the saving in the amount of labor required and also the reduced cost of maintenance. The engineers estimated that the entire cost of this installation could be repaid in 2 or 2½ years and this estimate is being very well borne out by the operating costs.

From previous experience and the amount of lime required it was decided to install three rotary kilns, 8 ft. in diameter by 125 ft. in length, each discharging into a rotary cooler 5 ft. in diameter by 50 ft. long set directly underneath. It was determined to fire the kilns by means of pulverized coal, and, after careful investigation it was decided to install two low side, six-roller mills, with the necessary bins, air piping and double-shell dryer. The plant was designed to have sufficient pulverizing capacity and storage space for crushed coal and pulverized coal so that all of the pulverizing for a day's run of the kilns could be done in sixteen hours. The pulverizing plant is therefore run for two shifts, while the rotary kilns are run continuously twenty-four hours a day with three shifts of men. The pulverizing plant has proved successful in operation and the room which houses it is practically dustless, removing the great hazard of dust explosions which formerly was present in the pulverizing of coal.

By following the course of the limestone one may get an idea of the essential storage handling and conveying system. The limestone, which is of high quality, is delivered on the company's dock by self-unloading boats during the summer and deposited in a storage pile by belt conveyors. It is reclaimed by means of locomotive cranes using clamshell buckets, and transferred to the lime-burning plant in hopper-bottom cars, where it is discharged into a track hopper in a car shed adjoining the lime-kiln building. From the track hopper the stone is elevated to three large storage bins, one at the feed end of each kiln into which it is fed in measured quantities by reciprocating feeders. Pulverized coal is blown into the kilns by an air blast through burners, which give approximately the proper amount of air for good combustion.

On account of the severe climate it was decided to house the kilns and pulverizing equipment, together with the waste heat boilers, in one steel-frame building covered with corrugated sheets. This building is 280 ft. long and 66 ft. wide in the main portion, with a lean-to car shed, 18½ ft. in width. The height from the floor to the lower chords of the roof trusses is 36 ft. Nothing in the design of the building is particularly novel, except that the roof consists of 13-gage corrugated zinc

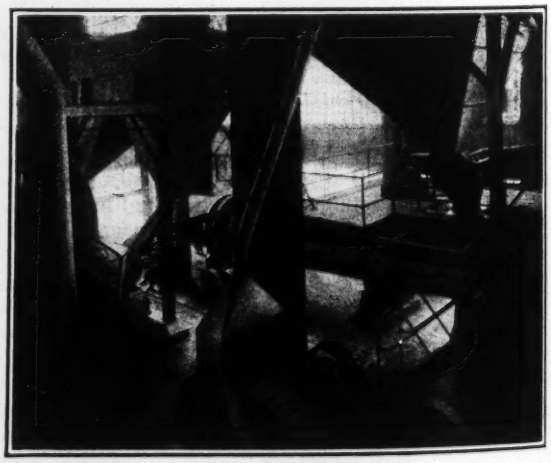


FIG. 2—COAL PULVERIZER PLANT FOR LIME BURNERS
Brick on cinder fill on ground floor and concrete for elevated platform. Mills and feed bin at left, welded rotary dryer in far corner and under 80-ton coal bin. Apron conveyor from track hopper to single roll crusher in foreground.

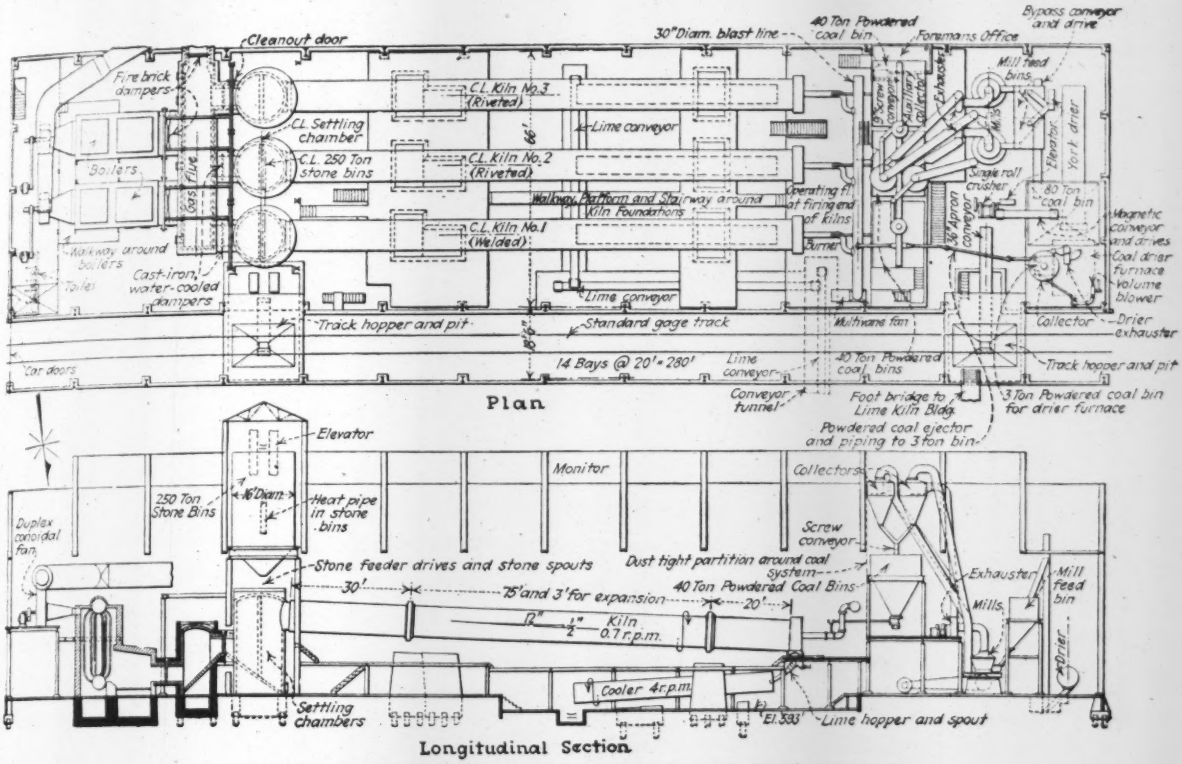


FIG. 3—ARRANGEMENT OF EQUIPMENT IN LIME KILN BUILDING

sheets, insulated from the steel purlins by means of wooden strips to prevent any possible electrolytic action. Asbestos cloth was placed in all joints between zinc and galvanized iron to prevent contact. The roof was designed for a total wind and snow load of 50 lb. per square foot and the columns were designed for a wind pressure on the side of the building of 20 lb. per square foot in addition to the weights transmitted from the roof trusses.

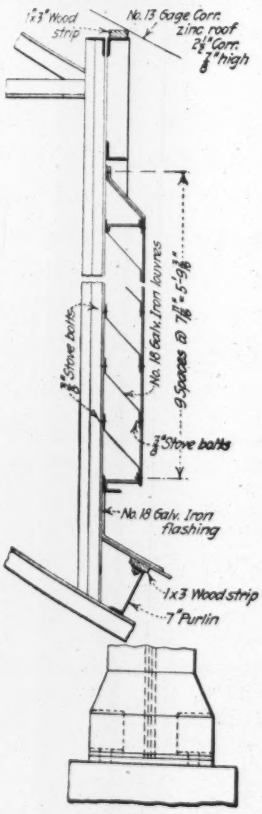


FIG. 4—DETAIL OF LOUVRE IN MONITOR

Originally the site of the plant was the shore line of the St. Mary's River, underlaid with soft river silt for a considerable depth. It was therefore necessary to drive 406 wooden piles for foundations for building, kilns and equipment. These piles were mostly 40 ft. long and were driven in accordance with *Engineering News* formula.

$$L = \frac{2WH}{S + 1}$$

In the design the piles were figured to carry 15 tons each, but in actual practice they were driven to sustain a load of 25 to 30 tons each. So far no settlement has been observed in any part of the construction. After being driven, the piles were cut off at the proper level and capped with concrete mixed in the proportion of one part of portland cement to five parts of clean river gravel. The concrete has shown no signs of failure or of being overstressed. The heaviest loads are the three kilns which weigh 165,000 lb. each including supporting rollers and bases but without the lining. When lined and filled to the proper operating level with stone and lime each kiln weighs 464,000 lb.

For the ground floor the earth was carefully graded, tamped and covered with a layer of clean cinders and then paved with vitrified paving brick. There is no second floor in the building but the platform around the firing end of the kilns consists of a 4-in. reinforced-concrete slab supported by structural steel. The top surface of this concrete was hardened by a floor hardening cement. Similar concrete platforms are provided under the pulverized-coal bins and under the fans at the waste heat boilers.

In order to avoid the danger of dust explosions, the pulverized-coal plant is cut off from the kiln room by means of a dust-proof partition formed of steel girts, metal lath and plaster. The firing end of the coal dryer is also separated from the pulverized-coal room by a dust-tight plastered tile partition. This dryer is so arranged that it can be fired by hand but it is ordinarily heated by a small pulverized-coal burner. It is found in actual operation that the cyclone dust catcher connected to the coal dryer collects sufficient dust from the coal drying to furnish all the heat required for drying the coal.

Not only must the partition be tight but the containers also. The three rotary coolers, 5 ft. in diameter by 50 ft. long, were welded from ⅜-in. plates. After

welding the heavy plates of the kiln (see below), these coolers did not present a particularly difficult problem, and smooth, accurate and dust-tight shells were obtained. The cylindrical stone bins were riveted but the pulverized-coal bins were oxyacetylene welded to make them absolutely dust-tight. A satisfactory result has been obtained as the powdered-coal room is perfectly clean and free from dust. In order to make the coal dryer dust-tight, the inner and outer shells were welded by the builder under the supervision and direction of the engineers of the Linde Air Products Co. The outer shell of this dryer is 70 in. in diameter by 35 ft. in length. It is absolutely dust-tight and runs perfectly true on the trunnions.

Before welding the coolers and dryers, one of the three kilns had been welded by the oxyacetylene process, as it was felt that a welded shell would be equally strong as, if not stronger than, a riveted shell and that it would show a lower cost for upkeep, since there would be no rivets to work loose and require replacing. The welding of this ⅝-in. shell was an interesting problem, successfully solved by the engineers and service operators of the Linde Air Products Co. in co-operation with the builders. It was necessary to devise entirely new methods, as the welding of such large, heavy cylinders had never before been attempted. The greatest difficulty encountered was to take care of the expansion and contraction of the plates during the welding process. Before deciding to use a welded kiln, the engineers realized that one of the greatest difficulties to be encountered would be in keeping the cylinder or shell true and straight so that, when revolved on the tires, it would not be out of true. Each kiln is carried on two 14-in. tires, supported on roller bases. The engineers were agreeably surprised to find, upon testing this kiln, that it was straighter than the riveted kilns. The specifications allowed the end of the kiln to be ¾ in. out of true when revolved on its trunnions, and the actual test of the welded kiln showed that it was only ⅜ in. out of true when revolved. Tests made on specimens of the same thickness as the kiln shell showed that the welded joint would develop at least 80 per cent of the strength of the plate. This welded kiln has been in continuous use since December, 1923, under a heavy load. Its performance has been satisfactory and has shown up very favorably with the riveted kilns alongside it in the same building.

In order to make the plant more efficient the engineers decided to utilize the heat from the spent gases by installing two 386-hp. vertical water-tube waste-heat boilers with a steam pressure of 165 lb. They will furnish steam for heating the plant, which in severe weather requires approximately 5,440 lb. of steam per hour. In addition there is sufficient surplus steam available to generate about 500 hp. to be developed at some future date. The carbide plant proper requires no steam except for heating, as all of the power used for the electric furnaces and motor drives is hydroelectric power furnished by the Michigan Northern Power Co. The waste gases are pulled through the boilers by means of two water-cooled fans. The temperature of the gases leaving the fans after passing through the boilers is approximately 450 deg. F.

The usual practice in installing rotary cement kilns and the practice followed at the other plants of the company in connection with rotary lime kilns, is to provide each kiln with a separate steel stack, lined with firebrick, but in this installation the gases from all three kilns are carried to one brick chimney 175 ft. in height by 7 ft. inside diameter at the top. It was early realized that, in order to get the proper draft on each kiln, where one common stack is used, a damper must be provided in the neck of each kiln to regulate the draft. Since no ordinary damper would stand the temperature, a water-cooled damper was developed which has answered every purpose.

Materials used in the construction of this plant were as follows: 406 spruce, tamarack and pine piles, approximately 40 ft. in length; 1,703 cu.yd. of concrete, 870,000 lb. of structural steel in building and supports, 230 squares of corrugated steel siding and 285 squares of corrugated zinc roofing.

The plant has been burning lime continuously since Dec. 5, 1923, with satisfactory results. As with all new plants, certain adjustments were necessary, particularly to the burners, on which there was very little previous experience to guide us in the burning of lime.

The design of the new plant was prepared in the office of the chief engineer of the Union Carbide Co. Construction was principally by contract, but the setting of the kilns, coolers, pulverizing machinery, elevators and conveyors was done by the company's own construction force.

European Iron and Steel Competition

JUST WHAT effect the Dawes Plan may have on the iron and steel industry has been analyzed as follows by an American official who is well informed on international economics:

"Keenest competition will arise in iron and steel. Plants in the Ruhr have been re-equipped and brought up to the most modern form, because the situation has been such that profits could be invested best in equipment. Some working agreement is certain to be made between the producers of the raw material in Lorraine and the steel makers in the Ruhr. In addition to being one of the world's most favored centers for steel manufacture, the Ruhr will have an additional advantage, for a time, in that the standard of living has been reduced greatly and low rates of wage will be acceptable. The living standard will increase gradually but the steel makers will continue to enjoy an advantage until this differential in their favor is overcome.

"Our industry is preparing to meet this situation by installing more labor-saving machinery. An indication that our manufacturers have on their fighting clothing is seen in their recent success in securing an order for 35,000 tons of corrugated iron in Argentina, an order for which the continental industry was striving.

"On the other hand the British steel makers are in a bad way. Few of their plants are modern. Instead of striving to reduce their costs effort appears to be concentrated on yelling at the government. Both labor and capital in Great Britain seem to have fallen into a psychological rut which is hampering them in meeting the increasing difficulties which they are facing. Such a large proportion of the British trade is with other countries that it is certain to be hard hit by the rehabilitation of Germany. A much smaller proportion of our trade is export. In addition, we are in a frame of mind which will do much toward enabling us to hold our own in the export market."

Old Bridges of Simple Type Still in Service in Pennsylvania

SEVERAL old bridges of very early types are still in service in certain parts of Pennsylvania. Failure of a bridge near Harper a short time ago, as noted in *Engineering News-Record* of July 31, p. 195, directed attention to the weakness of these old structures under modern highway traffic. This structure and two others of similar age but of different type are shown in the group of photographs herewith, reproduced by courtesy of James B. Long, consulting engineer, Norristown.

In the wrecked bridge, known as the Horst bridge, located between Harper and Jonestown, the trusses, of bowstring form, were built of a top chord made of a single 9-in. I-beam bent to roughly elliptical shape and a bottom chord of two 4x⅞-in. bars, with a web comprising light cast-iron verticals 6 to 8 ft. apart and 1-in. crossed diagonal rods. Wooden floorbeams rested directly on the bottom chord, and occasional diagonal braces from the top chord to floorbeam extensions held the trusses upright. Failure of the bridge appears to have been directly due to twisting of the trusses and buckling of the top chord initiated by this action. The bridge had been posted for a 3-ton load, but a 12-ton load was crossing it at the time it failed. The bridge was nearly 50 years old, having been built in 1878.

Other old bridges in the same region are of similarly defective construction, none having adequate top lateral bracing. The traffic over them is fairly heavy, and in consequence they are in danger of collapse from overloading.

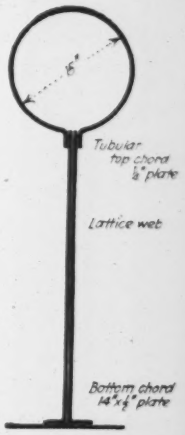


FIG. 2—TRUSS CONSTRUCTION, BLACK'S BRIDGE

Two of the old structures are shown at the right in Fig. 1. Like the Horst bridge they are of bowstring type. The structure shown in the upper view, known as the Jonestown bridge, has top chords of tubu-

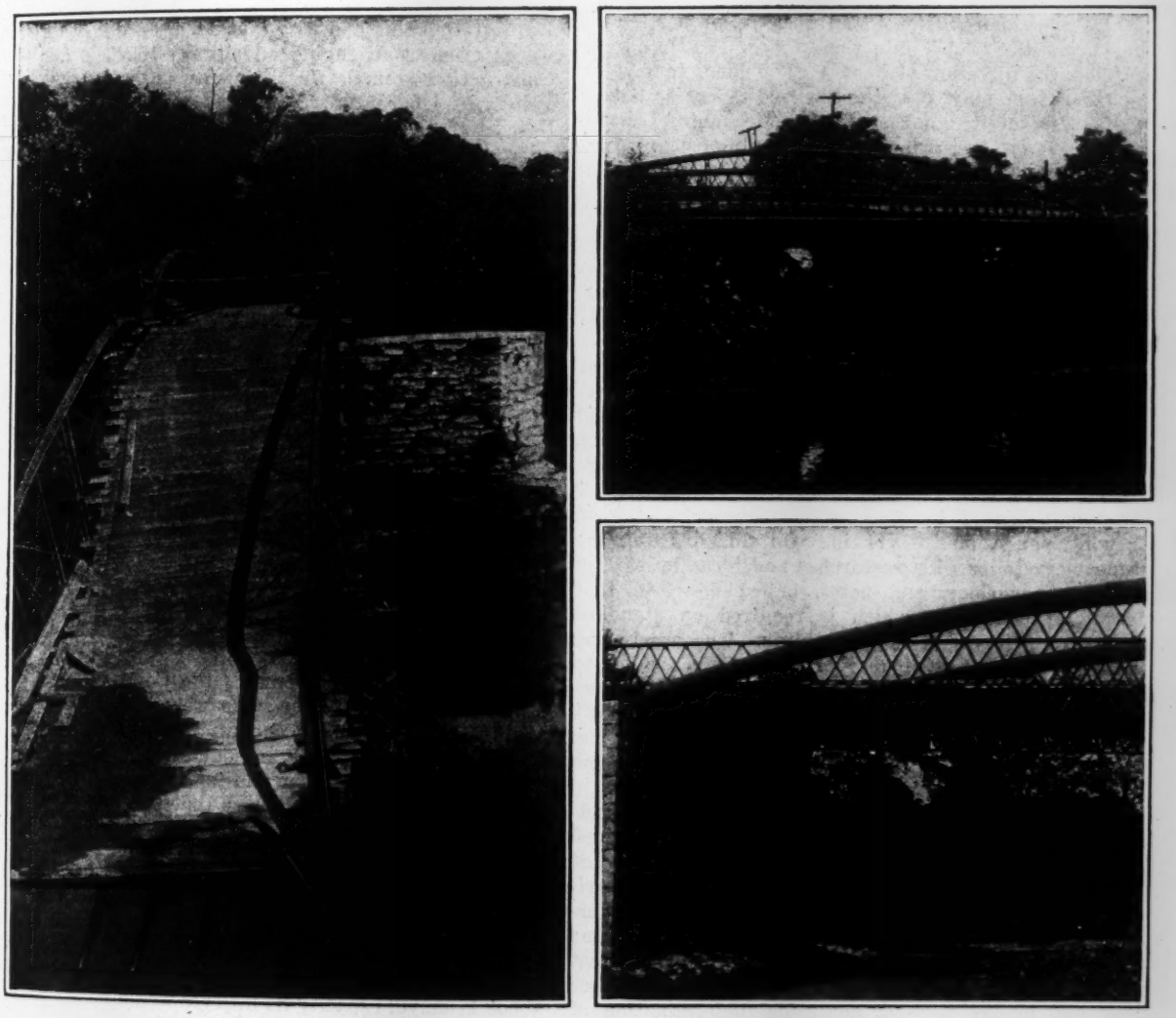


FIG. 1—THREE OLD HIGHWAY BRIDGES IN LEBANON COUNTY, PA.

At left—Horst Bridge, with two 106-ft. spans, one of which recently failed under a truck. At right—Two bowstring lattice bridges with tubular top chord. Above—Jonestown Bridge, two spans of 111½ ft. carrying a 20-ft. roadway; Below—Black's Bridge, two 119-ft. spans with 18-ft. roadway.

lar section made of four segments joined by flanges like a Phoenix column. The one shown in the lower view, Black's bridge, is of still more curious construction, each top chord being a 15-in. tube section made by bending a 14-in. plate, the meeting edges of which are flanged and receive the web lattice bars between them; the bottom chord is a 14x½-in. plate to which the ends of the lattice bars are riveted. The construction is shown by a sketch.

How the Laboratory Helps in Teaching Mechanics at Yale

By Thomas K. A. Hendrick
Instructor in Engineering Mechanics, Yale University, New Haven, Conn.

ENGINEERS have emphasized the development of sound engineering principles by the closer union of theory and practice. The young engineer is exhorted to maintain an active growth in practice by constant application to detail, design, construction, and critical study of engineering works. A very great part of the engineer's time is spent in the office. Office studies assume their paramount importance in proportion as they bring the "field" into their scope.

Under the direction of Prof. C. J. Tilden, four years ago, there was started at the Sheffield Scientific School of Yale University an Engineering Mechanics Laboratory based on the principle of bringing the field of actual engineering structures into the scope of the laboratory. A case system was formulated. Actual engineering structures are studied and the professional atmosphere created in order to bring embryo engineers at an early stage in their course of applied mechanics into contact with the fundamental axioms of engineering practice. Each case must be pruned very carefully to fundamentals.

The cases are worked up by references to the literature of engineering, the periodicals, society proceedings, journals, text-books, experimental data and conclusions, blueprints, correspondence, and reports. The research attitude of mind is fostered; also, the expression of the student's thought is emphasized by the submission of a report on a single page of good drawing paper, size 8½x11 in. On this drawing the student crystallizes his researches and ideas by careful sketches, equations, and notes, boiled down to that degree of exactitude which is required on standard engineering drawings and blueprints. The exactitude, the initiative, and originality of the student are left to his own development under the guidance of the instructor. In this case system an expression of the student's thought is seen at a glance by his "good work." Thus the principles of applied mechanics are brought home in the vivid reality as well as in the abstract.

Suitable cases on the principles of statics and kinetics are furnished by experiments on the three-hinged arch, reactions on suspension bridge cables, study of block friction in hoisting systems; efficiencies of various riggings such as, double and single burtons, differential pulleys, spur geared hoists; efficiencies of jacks; coefficients of static and kinetic friction under different conditions; accelerated motions; three-force members; roof and bridge trusses; centroidal determination of carriages, automobiles, locomotives; the effect of inertia forces; the moment of inertia of flywheels, shafts, standard shapes; the "M" of a flywheel, pulleys, rear wheels of heavy trucks; equations of motion; work and energy; impact and momentum; the principles of simple airplane flight.

For the different cases, no equipment is purchased all ready made-up. The details are designed and built in the laboratory. The three-hinged arch, for example, is designed to one-eighth size of the original which was built at Tempe, Ariz., in 1911, to carry the North and South Territorial Highway. A Sopwith experimental airplane was obtained from the government and is used to demonstrate types of construction as well as in explanation of the mechanics of simple flight.

A most important point in this course is the use of weights and equipment of big size to impress on the student an appreciation of the magnitude of forces, where the forces act, and in what direction. Heavy concrete blocks, heavy chains, manila rope, large blocks and tackles, large flywheels, in short an engineering scale compatible with a large and practical laboratory is the desideratum. It is the engineer's conception of forces and their analyses that is taught.

It was Doctor Fernow, an eminent forester, who said that 90 per cent of his time was spent in the office. He regretted this and as a true forester sighed for the woods even as an engineer longs for the field and the construction ground. In the above outline of the case system of laboratory engineering mechanics, it is believed that the ideal of the field is approximated in the laboratory.

Snow Removal on Fall River Road Across Continental Divide

Month Required to Open Highway—Hand Shovelers Dig Trench 6 Ft. Wide Over 12-Mile Stretch—Maximum Depth of Snow 19 Ft.

SNOW REMOVAL problems encountered in opening to tourist travel the Fall River road in Colorado, and the methods whereby these difficulties are overcome, are included in a letter written recently by Roger W. Toll, superintendent of the Rocky Mountain National Park. The Fall River road connects Grand Lake on the west side of the Continental Divide with Estes Park on the east side. As the railroads advertise this scenic trip, it is necessary to get the road open as early as possible in the summer. Weather conditions, however, make it impracticable to start work before the middle of May and it is usually possible to complete the snow removal in a month's time.

The Fall River road crosses the Continental Divide at an elevation of 11,797 ft. As prevailing winter winds are from the west, the summit of the pass is blown bare and the large drifts accumulate on the east slope of the mountain. Smaller and intermittent drifts naturally occur on the west slope so that the length of road to be cleaned of snow extends over 12 miles. The job then resolves itself into cutting a wagon road for 12 miles through snow of a maximum depth of 19 ft.

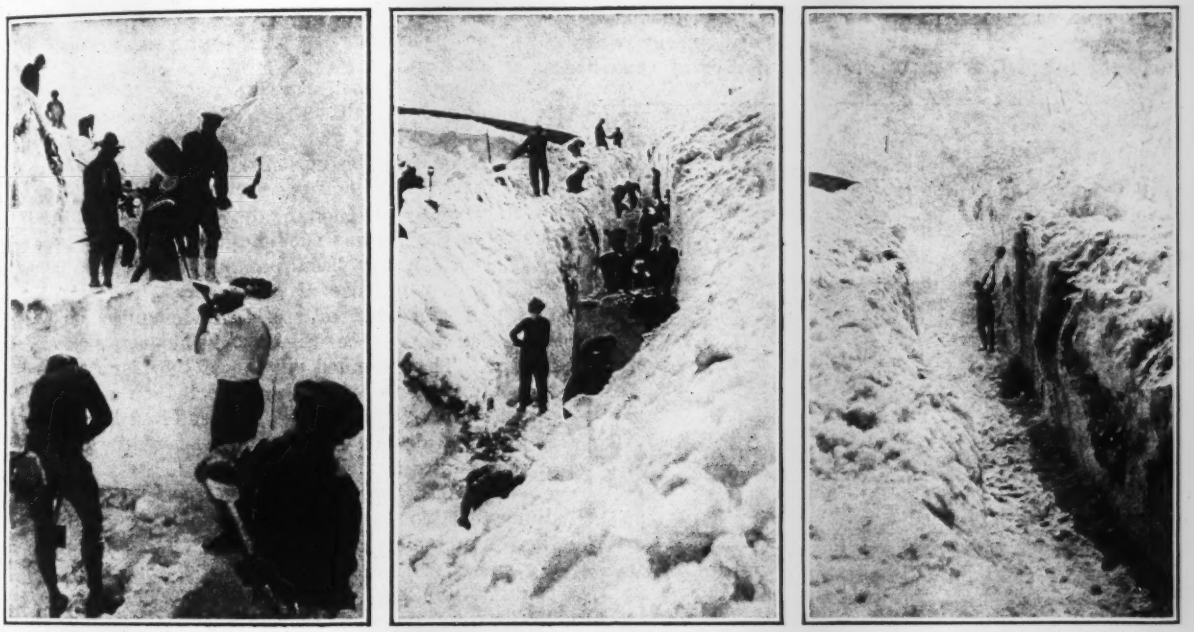
Mr. Toll explains that perhaps the most satisfactory method of snow removal would be use of a small steam shovel on a continuous tread mounting with a special dipper. If a ¾-yd. shovel were used, a snow dipper of about 1½-cu.yd. capacity he believes would be the proper size. He advises that the dipper should have a greater flare than is used for handling earth in order that the snow may be cleared without sticking. Though such

equipment is preferable to the manual methods employed by Mr. Toll, no money has been forthcoming with which to purchase and maintain such equipment. The method of attacking this snow-removal problem is explained in the following paragraphs:

A trench about 6 ft. wide is shoveled through the drifts, the bottom 30 in. overlying the ground being left. When the snow has been removed to this depth teams of horses in harness are driven through until they get a footing on the ground. After this, four horses are hitched to an empty wagon and this is pulled through the drift. Within a day or so the snow has sufficiently melted so that supplies for a camp can be hauled through the drift on wagons. The rest of the snow is melted out before the road is needed for automobile or truck traffic. If the trench does not melt sufficiently wide, a grader is used to widen it.

of from 6 to 8 ft. It took two days to take an empty wagon drawn by four horses 6 miles down the road from the camp. Many men who are employed for this work stay only a day or two. A bonus of 50c. per day is offered to the men who stay the season out, but many become snow blind through working a single day without dark glasses. Dark glasses and rubber boots, however, are furnished the men. Though some of them wear veils, grease paint or charcoal, nearly all are blistered by the sun. Within a year or so it is hoped that substantial quarters will be available at the pass, but at present a tent camp above the timberline is the only accommodation possible.

Numerous other methods of snow removal have been considered. The cost of snow sheds, Mr. Toll asserts, is prohibitive. Snow fences he deems worthless because the snowfall of the winter is as much as 25 ft. Experi-



CLEARING SNOW FROM FALL RIVER PASS OVER CONTINENTAL DIVIDE—ROCKY MOUNTAIN NATIONAL PARK

Work usually begins about May 15. Some two weeks after work has commenced the road is usually open up to the big drift which lies on the east side of the pass. Part of the men are then left to work on this drift while the others cross the pass and work down the west side. Ordinarily, the snow is sufficiently compact in the drifts to allow horses and lightly loaded wagons to traverse them without much difficulty.

Mr. Toll says that the conditions under which the men work on snow removal are extremely difficult. The winds near the pass are very high so that tents are torn and have to be particularly well anchored to keep them from being blown away. On June 10, 1923, 2 ft. of snow fell during a storm in the pass. Tents were crushed under its weight and the wind covered bedding, commissary and everything else with snow. This season, from May 25 to May 30, there was a continuous storm which added 3½ ft. or more of fresh snow at the pass. During this storm no work could be done and the men had to fight to keep their tents up. After the storm the drifts which had been previously shoveled out were partially filled up in some places to a depth

ments on a small scale have been tried with both salt and carbide, but with unsatisfactory results. A kerosene torch has also been considered, but computations indicate the progress would be painfully slow and equally as expensive as the method employed.

Explosives also have been tried out. During this year an iron pipe 2½ in. in diameter with a forged point was used to make drill holes in the snow. By screwing on additional sections of pipe it could be made 20 ft. or more in length. Holes were punched in the snow about 9 ft. apart and were column loaded with dynamite and fired simultaneously with a battery. A certain amount of snow was removed by this method, but that compressed by the explosion froze, and shoveling was thereby made much more difficult.

The du Pont Powder Company sent two of its men from Denver to the pass this year. They suggested an experiment whereby boxes of dynamite be placed along the road after it has become snowbound and ignited with a special fuse next spring when snow removal begins. It is possible that something of the sort may be tried out.

Rapid Strides Made In Yokohama Port Reconstruction

Restoration of Harbor Facilities Includes Extensive Work on Breakwater, Piers, Quays, and Warehouses to Cost $10,000,000—Precast Pier Caissons and Heavy Steel Girder Sections Are Features

By K. Koyanagi
Engineer, Yokohama Harbor Engineering Office, Department of Home Affairs, Imperial Japanese Government, Yokohama, Japan

FROM present indications the reconstruction work in Yokohama Harbor, made necessary through the earthquake damage of last September, will be completed and port facilities restored by the summer of 1925.

Soon after the earthquake last year, the Yokohama Harbor Engineering Office set up its reconstruction plans. The first step was the making of a precise survey of every part of the damaged quays, pier, and breakwater. From that survey, the reconstruction work was estimated to cost $5,000,000, or 10,000,000 yen, for each of two years. After the survey was made, the next step was cleaning the harbor of sunken

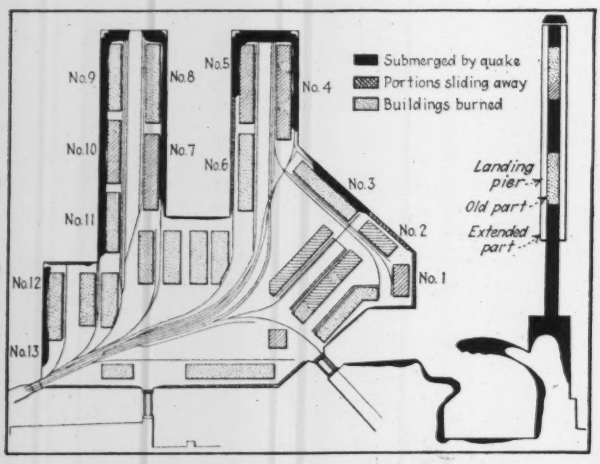


FIG. 1—DAMAGE DONE TO HARBOR OF YOKOHAMA

small vessels, overturned gantry cranes, which had been on the quays, and of sunken masonry and concrete blocks used in quay wall construction. Prior to that, however, arrangements had been made for installing concrete mixers for making precast sections for harbor facilities, providing temporary warehouses for construction materials, and gathering together those materials which comprised mainly cement, sand, gravel and timber. With such preliminaries disposed of, active work was begun on reconstruction, first, of the breakwater, then the chief pier, then quays and finally warehouses and sheds.

Breakwater—The breakwater was built up of heavy stone blocks resting on a rubble masonry overlying rather a soft mud. The earthquake shook down some of these blocks and the vibration made the breakwater settle generally until its top surface was below low water level. In the reconstruction, concrete blocks, each weighing about 7 tons, of which the breakwater was constructed, were used so far as possible. However, to a great extent, reconstruction was done by piling up concrete in bags on submerged blocks and filling intervening spaces with concrete poured from floating concrete mixing and distributing equipment. For this purpose, a mixing plant with a mixer of 10 cu.ft. capac-

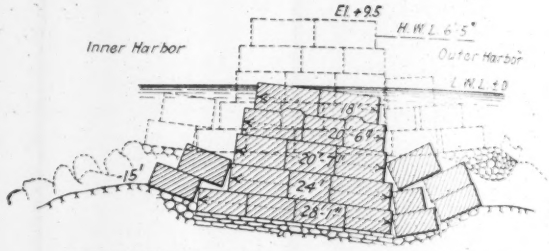


FIG. 2—SECTION OF DAMAGED BREAKWATER

ity was used. The breakwater was entirely completed to a height of 9 ft. 6 in. above low water line in April of this year. The manner in which this breakwater reconstruction was carried on is indicated in the accompanying illustrations.

Landing Pier—Though the landing pier, which is shown in Fig. 1, was considerably damaged, temporary reconstruction has been possible, so that it is made available for the use of passengers. The old part of this pier consisted of steel cylinder piles supporting a wooden floor (see Fig. 3). This was broken and burned. The extended portion of the pier consisted of a reinforced-concrete slab supported on a reinforced-concrete pile foundation. This suffered little damage. A practical design of reconstruction of the entire pier is now under investigation.

Quay and Quay Wall Reconstruction—The extraordinary earth pressure upon backfilling materials caused the quay walls to overturn or slide out. Early in November, 1923, sweeping of the sea bed had been begun. Sunken vessels, gantry cranes and concrete blocks were pulled out of the way, and dredging of the fallen backfilling material was in progress early in the winter. For this work, six floating cranes of 15 to 50 tons capacity, a dipper dredge, two pump dredges, four grab dredges, and numerous steel and wooden barges were used.

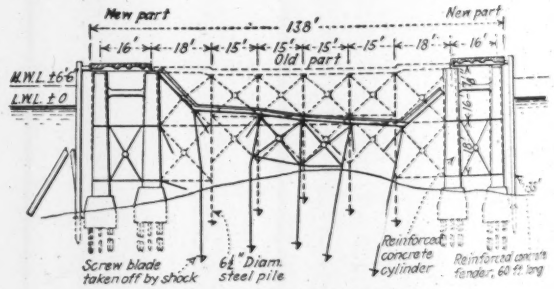
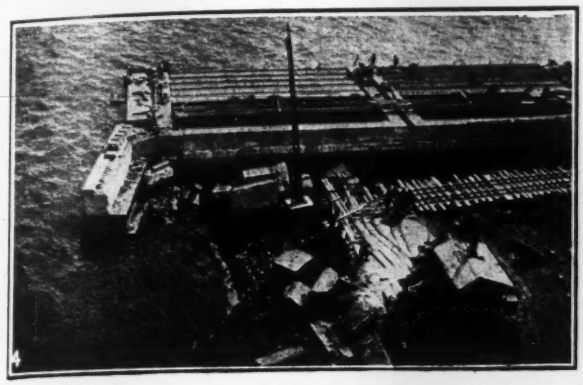
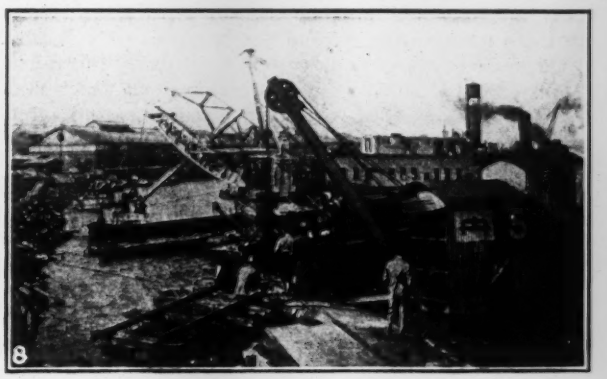
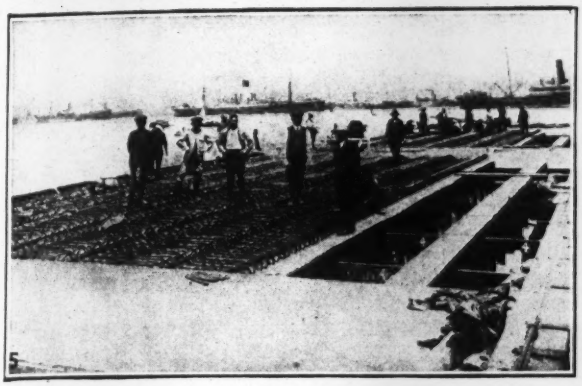


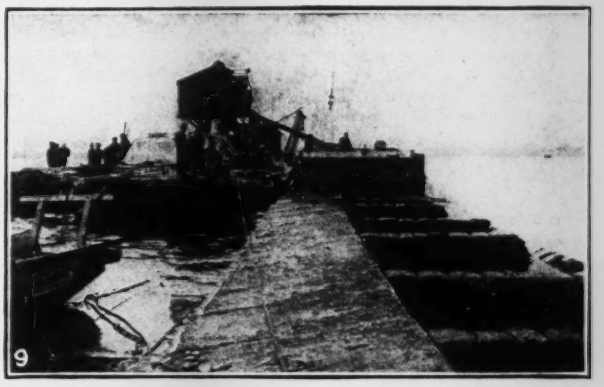
FIG. 3—SECTION OF DAMAGED PIER

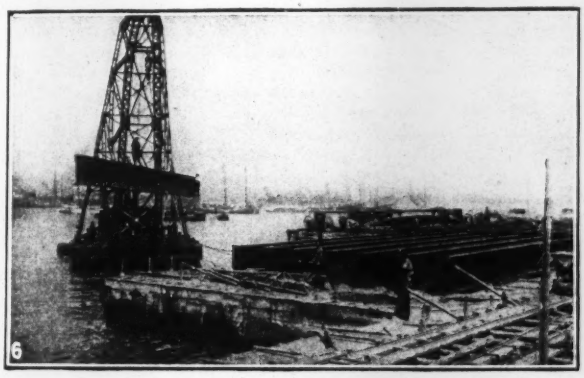
The reconstruction design of quays 9 and 11 consists in a 7-in. reinforced-concrete slab floor supported on plate girders 14 ft. deep and 55 ft. long, spanning reinforced-concrete piers. The 20 reinforced-concrete caissons for these piers, 9 of which are 33 ft. deep and of 300 tons weight, 11 of which are 29 ft. and

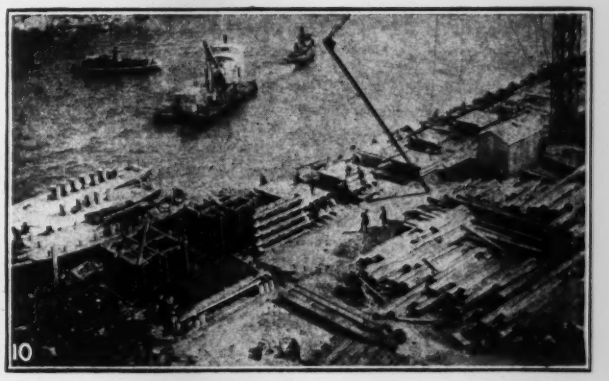


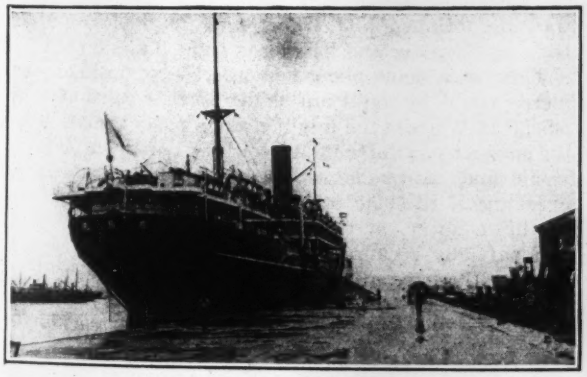












FIGS. 4 TO 11—HOW YOKOHAMA IS REBUILDING ITS PORT FACILITIES WRECKED BY EARTHQUAKE OF SEPT. 1, 1923

4: Cleaning harbor of earthquake wreckage. 5: Reconstruction work on breakwater. 6: Casting yard of concrete cellular quay caissons. 7: Placing steel girders on quay 9. 8: Laying 7-in concrete slab on quay 9. 9 and 10: Quay 9 being reconstructed and quay 9 finished. 11: Reinforced-concrete caissons cast in drydock.

240 tons in weight, were concreted in a drydock, two months being consumed in their construction. Work on these quays was completed in May.

Quay 4 has been reconstructed by utilizing the fallen blocks of the old quay as a foundation upon which rest concrete caissons filled with ballast and concrete poured with the caissons in place. The space between the blocks which were shaken down and those supporting the reconstructed quay is filled with concrete.

On quays 3, 5, 8, 12 and 13, cellular concrete blocks about 9 ft. high have been placed in two courses on a concrete block foundation. The cells of these blocks were filled with concrete when the blocks were in position; and joints were made between courses of these blocks by heavy steel bars. Reconstruction work on quays 2 and 6, rebuilt through the use of bags of concrete forming bulkheads between which concrete was poured, was completed in January.

Warehouses and Sheds—The damaged or burned warehouses will be rebuilt after the completion of the quay wall reconstruction work. A proper design of reconstruction is now being investigated.

Roads Bureau Discontinues Sample Testing

On July 1, 1924, the Bureau of Public Roads discontinued the general practice of testing samples of road materials for any citizen of the United States. Samples will be tested only when submitted by or at the request of a representative of the United States government, or of a state, county, or municipality, and then only when accompanied by a statement to the effect that the sampling was done by a disinterested party. This statement should be made on United States Bureau of Public Roads Form T-206, and should include the name and title of the sampler.

Russian Trade Difficulties

HOW DIFFICULT it is to estimate the possibilities of trade with Russia may be judged from the following statement as to the Russian situation by a well qualified authority in Washington:

"Russia at this time is making substantial purchases here of cotton, machine tools and certain other commodities. No confidence can be placed in the future of Russian trade. The establishment of buying commissions in foreign countries, including the United States, tends to bear out every pessimism regarding the policies of the Soviet authorities. Absolute control of purchasing centers in Moscow. Purchases are shifted quickly for political reasons. The German police, for instance, raided one of the Russian offices and in retaliation all the buying being done in that country was discontinued and transferred to other countries. Italy and Switzerland have been treated similarly.

This is a new phenomenon. No permanent commerce could be built up under such conditions. An official in Washington might make a nasty remark about the conduct of affairs in Moscow and our manufacturers would find the business they had built up transferred over night, to some other country. Russia is buying in this country, at this time, partially to cater to us and partially because prices are lower. Once recognition has been secured much of this business would be placed elsewhere to aid in gaining some further objective. The Russian agents, however, are preaching as they buy. They say much larger orders would be placed were Russia recognized. This argument is being pressed in connection with their purchases of cotton and our cotton trade is taking the bait. Sight is lost of the fact that with any return approximating normal, Russia again will become an exporter of cotton."

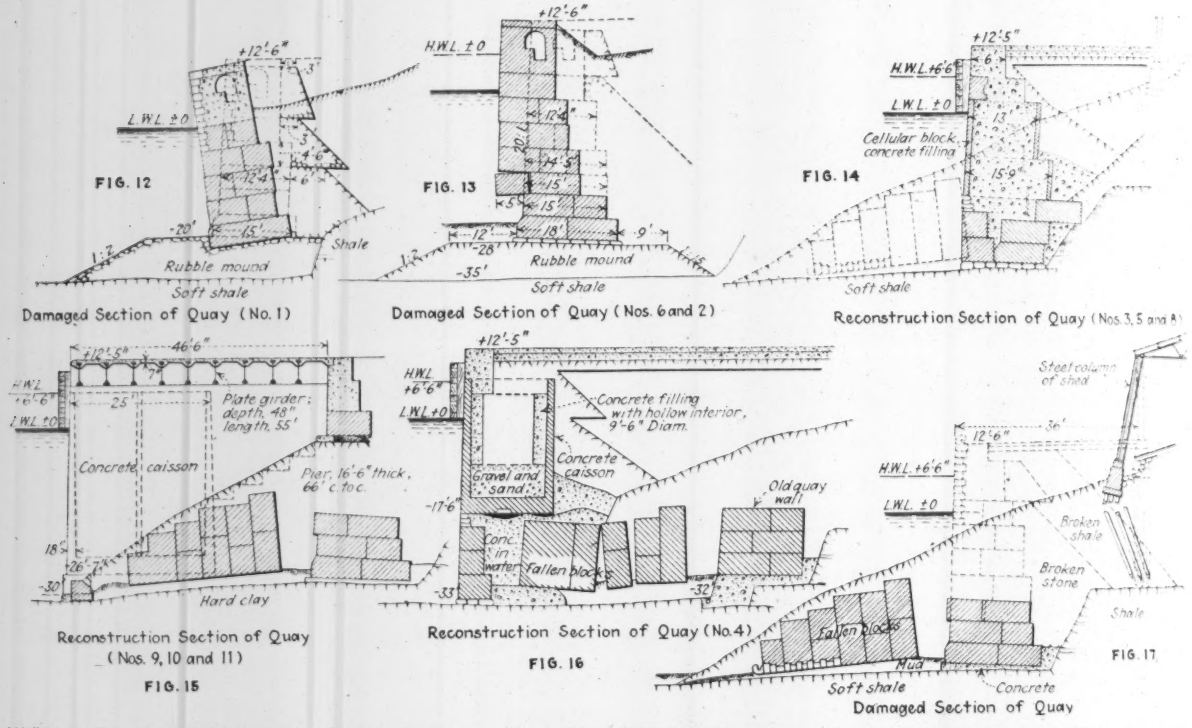


FIG. 12
Damaged Section of Quay (No. 1)
FIG. 13
Damaged Section of Quay (Nos. 6 and 2)
FIG. 14
Reconstruction Section of Quay (Nos. 3, 5 and 8)
FIG. 15
Reconstruction Section of Quay (Nos. 9, 10 and 11)
FIG. 16
Reconstruction Section of Quay (No. 4)
FIG. 17
Damaged Section of Quay

FIGS. 12 TO 17—SECTIONS OF QUAYS BEFORE AND AFTER RECONSTRUCTION OR AS THEY WILL BE WHEN REBUILT

Contract Surety Bond Conference Recommends Reforms

Joint Meeting of Contractors, Surety Men and State Highway Engineers Takes Step To Better Contract Bonding

A TWO-DAY conference was held at White Sulphur Springs, W. Va., on Sept. 19-20, at which committees representing the Associated General Contractors, the National Surety Association and the American Association of State Highway Officials brought before a representative conference of these three bodies some definite recommendations looking toward the bettering of conditions in the field of contractor surety bonding. The chairman of the conference is Gen. R. C. Marshall, Jr., general manager of the Associated General Contractors. This meeting was the second of the so-called Joint Conference, the first having been called at Washington on June 7 by Secretary of Commerce Hoover. At that time the conference appointed three committees, each having one member from each of the three interests, to bring in reports on specified questions. The White Sulphur Springs meeting was called to consider the reports of these committees and to take action thereon, though the conference cannot bind any of its constituent bodies to action.

The reports are given below. Following their submission there was extended discussion of each report, but the only formal action was to accept the reports and to pass the following resolution:

It is the sense of this meeting that the reports of the committees and the action here taken thereupon be respectfully referred to the Surety Association of America with request for an expression of its opinion and with the suggestion that, as an initial step, the Surety Association of America inform this conference of its views and purpose, looking toward the active, prompt and effective establishment of local agency associations throughout the country and of a corresponding denial of reinsurance facilities to non-conforming companies, it being understood that any well considered plan will have the support and co-operation of the other parties to this conference.

The committee reports are as follows:

Information Bureau and Free Service—The subjects assigned to Committee 1 were:

(*a*) Information bureaus for ascertaining the responsibility of contractors.

(*b*) Free service of surety companies—estimating, engineering advice, bidding information, etc.

At the outset, this committee desires to emphasize the fact that in a real and vital sense the interests of the contractors, the surety companies, and the owners who are having work done are identical. When a surety company writes a bond for a contractor, the surety company and the contractor become in effect partners. If there is a default, the owner suffers delay and other consequential losses not covered by the bond. The contractors, the surety companies, and the owners are therefore interested in the establishment of conditions under which defaults are least likely to occur. A default means loss for all three parties concerned.

This committee desires further to emphasize the fact that at present conditions are not satisfactory. Practically any contractor, whatever his financial standing, whatever his experience or lack of experience, whatever his equipment, sufficient or insufficient, whatever the relation of his liquid assets to the amount of work he has on hand, whatever the extent to which he has become over-extended, can obtain a bond. Some surety company will execute a bond for him, and he goes from one company to another till he gets what he wants. The irresponsible contractor can usually find some company to go surety for him. This is the result of competition. As bearing on the conditions, it should be noted that it is the almost invariable practice for the owner to award the contract to the lowest bidder. The consequence is that the surety company must execute the bond for the bidder who presents the greatest hazard in the group of bidders. The surety company gets the worst risk in the lot. The selection is against it.

It will be evident that the problem is a very difficult one to solve. Competition prevents the establishment of wholly satisfactory conditions.

This committee was asked to report whether territorial information bureaus would be a solution of the problem. The function of these bureaus would be to investigate contractors and to gather all the facts about them and to report to the companies and their agents as to their worthiness or unworthiness as respects the execution of bonds for them.

The surety companies at an informal and advisory meeting expressed the opinion that territorial information bureaus were not a solution of the problem. After further and more mature consideration, this committee is still strongly of the opinion that these territorial bureaus (with a central control office as a clearing house) offer the only practical method of instituting reform in present practices and for throwing a searchlight upon the practices of irresponsible underwriters. It therefore, strongly urges upon the surety companies a reconsideration of the entire question.

The surety companies also decided to recommend to the Associated General Contractors that its members give better co-operation to the surety companies in furnishing the companies with accurate information when the companies ask for the same.

The surety companies further decided to recommend to surety company officials and to the Surety Association of America that a Contract Bond Underwriters' Association be formed. The purpose of this association will be to get underwriters acquainted, to enable them to discuss problems and to exchange views on underwriting methods, and to secure closer co-operation between companies.

In considering the necessity of establishing better conditions than exist at present, this committee desires to point to a development that has come to its attention. It is credibly informed that the United States Government Interdepartmental Board, of which Gordon Ramsay is chairman, and which board reports to the Director of the Budget, who in turn reports directly to the President of the United States, is considering the advisability of recommending that bonds from surety companies be done away with. It desires also to point out that in the state of Kentucky a great many highway contract lettings, the greater number in fact, are being made without the requirement of surety bonds.

It will thus be seen that a part, and an important part, of the contract bond business of the surety companies is in jeopardy. In this situation this committee believes that no mere palliative action will suffice to satisfy the government officials, but that a real and effective remedy is required, such as the territorial information bureaus previously referred to herein are believed to constitute.

As respects free service to contractors, the surety companies, at their informal and advisory meeting, expressed the opinion that it was not possible for the companies as a body to take any action on the matter, that it was a matter which would have to work itself out. Opinions were expressed, however, that in the end free service to contractors would not be found useful to either contractors or surety companies.

This committee desires to report that it believes surety companies should confine themselves to their legitimate function as sureties and should not go beyond this function. The giving of free engineering advice leads many to bid on work for which they have not the ability, or experience, or equipment to handle, to the detriment of qualified and responsible contractors. So, also the free distribution of unit price information misleads many unqualified persons and suggests to them the undertaking of work for which they have neither capability nor facilities. Mass psychology comes into play and operates to the disadvantage of all. For when information regarding unit prices is

widely disseminated, everybody is unconsciously influenced to accept the approximate level of prices revealed as a yardstick of true costs irrespective of the underlying economic conditions. It is no doubt true that a surety company may gain some temporary present advantage by distributing unit price information broadcast, but the question may well be considered whether it should not be willing to forego this in view of the detrimental effects the distribution produces, and which will ultimately react to its disadvantage, no less than to others.

In conclusion this committee desires to reiterate its belief that the interests of contractors, surety companies, and owners are identical, and to express the hope that a way may be found and means provided for closer co-operation between these three factors in the situation. One way to bring about this co-operation perhaps would be for a committee of the Associated General Contractors of America and a committee of the Surety Association of America to meet together from time to time, or better yet at regular stated intervals, to discuss their common interests and problems, and to devise so far as possible solutions to recommend to their respective principals. This committee is of the opinion that much good has been accomplished already by the contractors and surety companies getting together and frankly discussing with each other their difficulties and problems. This forward step should, this committee believes, be succeeded by others.

E. A. ST. JOHN, Pres., National Surety Co., *Chairman.*
H. H. WILSON, Winston & Co., Contractor.
W. H. CONNELL, Deputy Secretary of Highways, Pennsylvania.

* * *

Qualification, Uniform Contracts, Day Labor—After conducting its investigation of the several subjects assigned Committee 2 reports as follows:

Qualifications of contractors and financial statements: The committee believes that a great deal may be accomplished toward eliminating the irresponsible contractor if the surety companies will revise upward their underwriting requirements, requiring more definite knowledge of the contractor's experience, plant and equipment, sufficiency of bid price, the amount and condition of work under way and will require him to show a greater margin of current assets in proportion to the contract work undertaken.

The committee has obtained from representative surety companies a copy of their financial statements which contractors are required to submit and finds that though there is some variation they are much alike in substance. A greater amount of detail it is believed will be of material aid in determining a bidder's true financial responsibility.

The financial statement used by the Standard Accident Company appears to be a very satisfactory statement and the committee suggests that this statement be used as a basis for compiling a uniform statement to be submitted later to the conference. When the conference shall have adopted a form of statement which it considers satisfactory, it is suggested that this statement then be referred to the Surety Association of America, with recommendation that it become a standard form for that Association to be used by all surety companies constituting its membership.

At a meeting which your committee had in New York with representatives of the various surety companies it was the consensus of opinion that they would favor a uniform financial statement.

Progress reports of construction: The committee has investigated the forms of progress report used by various companies and finds that while different in some respects, they ask for substantially the same information. The committee does not see any particular advantage in the adoption of the uniform progress report but feels that if the joint conference favors a standard form the surety companies would probably consider its adoption.

Uniform contracts for construction: It is the belief of this committee that the adoption of uniform and economically sound contract principles and on all public construction projects will bring a great amount of desirable stabilization to the industry, and it recommends that surety companies, contractors, engineers and architects urge the adoption of construction contracts conforming as nearly as the various laws will permit with the documents of the Joint Conference on Standard Construction Contracts.

Day labor construction: The construction of public works by day labor which has noticeably increased within recent years is held to be economically unsound and conducive to the spread of socialistic doctrines. The committee recommends that this encroachment of government upon private industry be vigorously opposed by the surety companies, engineers, architects and contractors.

F. L. CRANFORD, Pres., Associated General Contractors, *Chairman.*
F. A. BACH, Vice-Pres., Fidelity & Deposit Co.
W. R. NEEL, State Highway Engineer, Georgia.

* * *

Other Surety, Contract Enforcement, Publicity—Committee 3 has investigated the subjects assigned to it and herewith reports upon these subjects.

Forms of surety other than the corporate surety bond: Investigation of this subject has dealt with the advantages and disadvantages in comparison with the corporate bond of personal sureties, negotiable securities, and increased retained percentages. Detailed discussion of the respective merits and weaknesses of these alternate forms, which are generally understood by members of the joint conference, is too voluminous for presentation at this time and the committee submits merely the results of its deliberations.

With any of the substitutes for corporate suretyship certain features are to be encountered which require the exercise of caution in order to provide proper and necessary safeguards. Personal surety is considered least desirable, negotiable securities and greater retained percentages may be more satisfactorily used.

While the writing of corporate bonds in many instances has been attended by practices causing an unfavorable reaction and frequently making them an unsatisfactory form of protection, the committee believes that by placing into effect the constructive measures now being considered by the Joint Conference, this form of suretyship can be made satisfactory.

Uniform enforcement of time penalties of the contract: Because of anticipated laxity in the enforcement of time penalties bids are sometimes submitted with more or less confidence on the part of the individual bidder that the penalty will not be enforced. Non-uniform enforcement of the penalty enables such bidders to bid below competitors who expect to abide by the time limits stated thus making possible unfair competition.

The committee recognizes that often the time of completion is delayed by causes beyond the control of the contractor and the committee believes that in all such cases the engineers should grant the contractor a reasonable time extension.

The committee recommends that public officials adopt a uniform policy of time extension and enforcement of time penalty.

Publication of the name of the surety for each construction contract: The committee has investigated the probable effects of making public the name of the surety bonding each construction contract. It recommends that this procedure be adopted with respect to all contracts for public construction and that public officials notify the home office of the surety company when the bond is received.

The purposes of such procedure are as follows:

(1) To direct attention to any political group or any public officials that may be exercising any influence on the placing of surety bonds through some particular agent or surety company.

(2) To provide that reputable contractors and surety companies may know what sureties are bonding irresponsible bidders.

(3) To prevent representatives in cases of doubtful risk that some other surety is willing to write the bond, by this means it will be possible after the bond is written to check up such representations and irresponsible statements.

(4) To prevent irresponsible agents from executing bonds and not reporting them to the home office of the company.

P. ST. J. WILSON, Chief Engineer, Bureau Public Roads, *Chairman.*
L. C. WASON, Aberthaw Construction Co.
E. W. BUSH, Engineer, Aetna Casualty & Surety Co.

Hay Pays Half Maintenance Cost of Yazoo Levee District

Bermuda Grass Yield on 98½-Mile Stretch Along Mississippi Justifies Plan Inspired by Major T. G. Dabney

By C. W. Littlejohn
Clarksdale, Mississippi

HAYMAKING is paying more than half, and in time bids fair to pay all, of the maintenance expenditures of the Yazoo Mississippi Levee Board, which body guards a 98½-mile stretch in the Delta.

Major T. G. Dabney, consulting engineer of the board, whose career as a Mississippi River engineer has brought recognition to his state and the nation, has within the past two years demonstrated to the taxpayers of this district that the business man's brain can very profitably combine with the calculating mind of the engineer. Within the two years an economic factor in the district's maintenance system may be said to have been given, for the first time, a thorough trial, and it has been found efficient. This factor is the growing of Bermuda hay on the levee, harvesting and marketing it at a profit which, last year, paid more than half the cost of maintenance, estimated at $75,000.

In 1910 Major Dabney proposed his plan to the board of levee commissioners, but that body failed to take any action. It was proposed by Major Dabney again in 1918 to the board of commissioners then acting and adopted by them. Since 1918 the system has been employed on the levees of the district though only in the past two years has it paid a considerable part of the cost of levee maintenance. Throughout the past 20

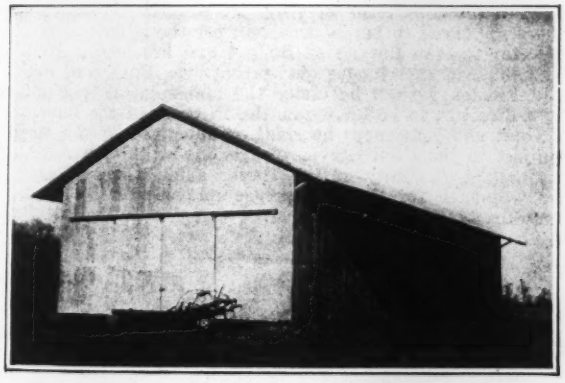


FIG. 1—NEW SHEDS FOR STORING LEVEE HAY

years of Major Dabney's career with the levee board, the present chief engineer, W. L. Head of Clarksdale, Miss., has been Major Dabney's assistant; at this time he is carrying through the Dabney plan.

The levee board of this district has hay acreage averaging between 25 and 30 acres to the mile on the levee embankments and about 50 acres to the mile in the borrow pits and on the berm, or a total acreage of more than 7,500 on the 98½ miles of levee. During the past year the levee-grown hay has furnished more than 400 tons for the levee's mules and in addition has made possible the sale of more than 3,000 tons on the open market at a net gain of more than $40,000. This hay crop is harvested by the levee maintenance forces.

The maintenance system consists of a dozen station houses, spaced eight miles apart along the levee line, each station having a well built foreman's house, barn, tool shed, laborers cabin and hay shed. The working force of each station consists of a foreman, 8 to 10 laborers, 11 mules and all necessary implements. The station houses cost $80,000 and equipment $60,000.

The purpose of the maintenance system is to keep the levee and the right-of-way in first-class condition at all times; to repair rain wash and wave wash on the levee; to keep the levee and the right-of-way free of weeds, briars and bushes; maintain a good and passable

FIG. 2—ONE OF 12 MAINTENANCE STATIONS
Buildings comprise foreman's house, cabin for laborers, barn and tool house.

road along the levee for easy and hurried access to any part thereof; to police the levee and put a stop to all violations of the laws made for its protection; and in times of high water to perform a multitude of duties necessary to the proper conduct of a high water fight, watching the levee and right-of-way for any weakness that might develop. The system makes it possible to rush an adequate and thoroughly organized force to any point of danger, as was done at "Devil's Hole" in Tunica County during the high water of 1922, when a threatened break in the levee made imminent the inundation of thousands of acres of the most fertile lands.

During the past year at a very low comparative cost, an additional economic hay-making feature has been added by Mr. Head, who has caused to be built 10 sheds, 32 ft. wide, 84 ft. long and 16 ft. high, with capacities of 250 tons of baled hay each, the ten sheds costing approximately $7,000. There are few contractors in this community who would undertake to build one of the sheds for less than $1,200. The low cost of this construction work was made possible through the utilization of the timber on the levee right-of-way and the use of levee labor and levee teams in the hauling.

Without the sheds the chief engineer, under whose direction the hay sales are made, was forced to sell the hay as it was baled last year at a sacrifice which may be conservatively estimated at $5 per ton. This year the hay was held until there was a demand for it on the market and as a result there has been saved a sum which will be more than double the cost of the sheds.

How to Inspect Portland Cement

The United States Bureau of Standards has issued in manuscript form a code of instructions entitled "Inspection of Portland Cement" by J. R. Dwyer and Roy N. Young. The document goes much more fully into the technique of cement inspection than do the standard specifications and includes a fairly full statement of the practice of the Bureau of Standards in this cement testing work.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Beam Deflections By Coefficients

Sir—Professor Laurson's article on calculation of beam deflections by the area moment method, p. 424 of the issue of Sept. 11, is well written and worthy of careful study. But the method given is rather too lengthy for the present day structural designer, who has no time for the more exact calculations but depends on careful slide-rule work. If lengthy formulas are involved even that requires too much time, and practical short cuts must be resorted to.

The writer has found from experience that deflection coefficients afford the most practical solution of deflection problems and while not exact to the highest degree will give exceedingly close results. These deflection coefficients may be very readily computed, and easily remembered by keeping in mind the fact that they are equal to a fixed ratio of the span length multiplied by a ratio of the unit stress and variable factors of unit stress for different conditions of loading.

Professor Laurson has taken for his example a simple beam of 12-ft. span loaded with a uniform load of 50 lb. per lin.ft., a concentrated load of 1,200 lb. at a distance of 5 ft. from one end, and a 4-ft. length of distributed load of 300 lb. per lin.-ft. beginning 1 ft. from the opposite end. The end reactions and maximum bending moment were necessarily computed in order to determine the size of the beam required to safely support this condition of loading. The moment divided by the section modulus of the adopted beam would give the unit stress. In this case he selected a 5-in. 10-lb. I-beam and computed the deflection at midspan by the area-moment method.

It will take the reader but a moment or two to compute the moment at the center of the span, and the unit stress will be found to be approximately 14,250 lb. per sq.in.

For beams with partial uniform loads and concentrated loads as in this case, the writer would use the rule that the deflection coefficient is equal to one-thousandth of the square of the span length in feet for each thousand pounds of unit stress. The deflection is equal to the coefficient divided by the depth of the beam in inches.

Applying the above rule in this case the deflection of the 5-in. I-beam would be,

$$\frac{12^2}{1{,}000} \times \frac{14{,}250}{1{,}000} \times \frac{1}{5} = 0.4104 \text{ in. deflection}$$

which is 0.0008 less than the machine-calculated value found by Professor Laurson, but is close enough to suit the most exacting designer.

This is not the maximum deflection, however, as the point of maximum moment is under the 1,200-lb. concentrated load. At this point the unit stress is 14,650 lb. Then the maximum deflection is,

$$\frac{12^2}{1{,}000} \times \frac{14{,}650}{1{,}000} \times \frac{1}{5} = 0.4219 \text{ in.}$$

Using 29,000,000 as the modulus of elasticity of steel, the deflection coefficients for beams under different conditions of loading will be approximately equal to one-thousandth of the square of the span length for the factors of unit stress given below.

DIVISORS FOR COMPUTING DEFLECTION COEFFICIENTS FOR BEAMS

Simple beam, uniformed load	967
Load at center	1,200
Fixed beam, uniform load	1,611
Load at center	2,400
Cantilever beam, uniform load	403
Load at free end	300

To illustrate the use of these co-efficients: Suppose a simple beam of 20-ft. span has to carry a uniform load of 18,000 lb. As a 12-in. 31.8-lb. I-beam at 16,000-lb. unit stress is good for 19,180 lb. on a 20-ft. span (by tables of safe loads), it will be selected. Then its unit stress at midspan is equal to $\frac{18{,}000}{19{,}180} \times 16{,}000 = 15{,}000$. Taking the divisor 967 from the above list, the deflection coefficient is, $\frac{20^2}{1{,}000} \times \frac{15{,}000}{967} = 6.2$ and the deflection is $\frac{1}{12}$ of 6.2 or 0.517 in., say $\frac{1}{2}$ in. Under a concentrated load, strange as it may seem, the beam would deflect less, because the moment area is less. A concentrated load of 9,000 lb. at midspan would give the same unit stress of 15,000, and the deflection would be,

$$\frac{20^2}{1{,}000} \times \frac{15{,}000}{1{,}200} \times \frac{1}{12} = 0.417$$

Checking this result by the formula given in the general run of hand-books:

$$\text{Deflection} = \frac{PL^3}{48EI} + \frac{5WL^3}{384EI}$$

$$\text{Deflection} = \frac{9{,}000(20 \times 12)^3}{48 \times 29{,}000{,}000 \times 215.8} + \frac{5(12 \times 31.8)\ (20 \times 12)^3}{384 \times 29{,}000{,}000 \times 215.8} = 0.424 \text{ in.}$$

This result, which took considerable time to compute, checks the coefficient method with a difference of less than one hundredth of an inch, which is not worth considering.

For most cases of simple beams in ordinary building construction, the rule that the deflection coefficient is equal to one-thousandth of the square of the span length in feet for each thousand pounds of unit stress will give very close and practical results and is very easy to remember.

Wilmington, Del. C. B. DANNENBERG,
Sept. 19, 1924. Structural Engineer.

Overlooked Point in New Los Angeles Charter

Sir—In summarizing the new charter of the City of Los Angeles in your issue of Aug. 28, p. 338, you stated that there appeared to be no provision for the appointment of a director for the Bureau of Budget and Efficiency. Art. 29, Sect. 397, of the charter states that "the Bureau of Budget and Efficiency shall be under the management and control of a director, to be known as the Director of the Bureau of Budget and Efficiency; he shall be appointed by the Mayor, subject to the Civil Service provisions of this charter; and it shall be the duty of the Mayor and Council to provide by ordinance for the necessary employees for the work of the Bureau." F. D. HOWELL.

Los Angeles, Sept. 4, 1924.

Culling Out Brittle Bars of Rerolled Steel

Sir—I am sorry that my letter to you published in your Sept. 18 issue of Engineering News-Record, p. 475, under the heading, "More on Rerolled Rail Steel," was not quoted correctly. The main part of the third paragraph should read:

"The manufacturers of new billet bars should do two things: Increase the strength of their bars, and make it possible to separate at sight the different grades of bars, so that mixing up of different grades will be impossible. The manufacturers of rerolled bars should take steps to cull out all rails which from their carbon and phosporus content are likely to produce brittle bars."

As the letter was printed, the first eight words of the second sentence were omitted, so that the statement about culling out rails which might produce brittle bars was made with reference to manufacturers of new billet bars, instead of referring, as it should have, to manufacturers of rerolled bars.

J. B. KOMMERS,
Associate Professor of Mechanics,
University of Wisconsin.

Madison, Wis.,
Sept. 4, 1924.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

East Bay Cities to Vote on $39,000,000 Water Bonds

Mokelumne River Source and Purchase of Company's Distribution System Would Cost $64,000,000

The board of engineers retained by the East Bay Municipal Utility District to report on the most suitable source of water supply has recommended the Mokelumne River and accordingly a bond issue of $39,000,000 to develop this source will be voted upon at the Nov. 4 election.

The cities comprising this district are Oakland, Berkeley, Alameda, Piedmont, Richmond, San Leandro, Albany, Emeryville and El Cerrito. The board of engineers consisted of Arthur P. Davis, chief engineer and general manager of the district, William Mulholland, and General George W. Goethals. The total amount of bonds that the district may now legally issue is about $64,000,000. The board recommended that $25,000,000 be reserved for the purchase and extension of the present water distribution system, leaving $39,000,000 for developing the first unit of a new source of supply. The cost of bringing in the first 50 m.g.d. from the Mokelumne can be kept within $35,000,000, the report stated, leaving the remaining $4,000,000 to cover interest during the construction period, which is estimated at four years. Additional units are to be added as the needs of the cities and the bonding limit increase, until a total of 200 m.g.d. has been developed.

The board of engineers first reviewed the studies and compilations made for the various water-supply projects that had been considered for the San Francisco Bay region, including the surveys made in the past four months by the East Bay Municipal Utility District engineers. Then about ten days were spent in a rapid field reconnaissance of the four most promising sources: The Tuolumne River or Hetch Hetchy project, the Mokelumne River, the Eel River and the Upper Sacramento River. The final decision in favor of the Mokelumne confirms the previous findings of Mr. Davis.

The Mokelumne project involves a dam at Lancha Plana, about 30 miles northeast of Stockton, and an aqueduct about 90 miles long from that dam to the reservoirs now supplying the East Bay district. The report cites five major reasons for selecting the Mokelumne, as follows: (1) The supply is the nearest of any of which the quality is satisfactory. (2) In its ultimate development to a satisfactory magnitude it is the cheapest available. (3) It would stimulate and assist in the development of irrigation and local domestic water supply. (4) It is adapted, better than any other project, to use without waste in bringing quickly to the district a temporary pumped supply from the winter waters of the San Joaquin River. (5) The drainage basin is practically uninhabited and unpolluted, and is devoid of natural resources likely to attract material development and consequent pollution.

The temporary supply to be taken from the San Joaquin River for emergency use is regarded as a safeguard for the East Bay cities should there be other periods of drought. At present East Bay cities are receiving two-thirds of their water supply from wells of the East Bay Water Co., whose reservoirs will be exhausted by January or February.

Reasons given for not participating in the Hetch Hetchy project are: (1) Failure of San Francisco to give terms and conditions under which the East Bay may purchase water or any indication of what those terms might be; and (2) the cost of completing the Hetch Hetchy project is "a matter of conjecture."

Conference on Sewage Treatment to be Held in Iowa

The sixth Iowa conference on sewage treatment, organized for the benefit of municipal officers and others concerned in the satisfactory operation of sewage-works, will be held at the Iowa State College, Ames, Iowa, on Oct. 28 to 30.

Tablet in Memory of Aspdin Unveiled at Leeds

Gift of American Portland Cement Association to Commemorate Issue of First Patent

On Sept. 6 there was unveiled in the city hall of Leeds, England, a bronze tablet commemorating the centennial of the patenting of portland cement by Joseph Aspdin, a native of Leeds. There were present at the ceremony Joseph William Aspdin, a great grandson of the inventor, and number of other relatives. The presentation was made by the Portland Cement Association of America through its president, F. W. Kelley, and the tablet was received for the city of Leeds by Sir Edwin Airey, Lord Mayor of Leeds.

A delegation of nineteen representatives of the Portland Cement Association; P. M. Stewart, chairman of the British Cement Makers Federation, and other British manufacturers participated, as did the aldermen and councilmen of Leeds, and many citizens.

The addresses emphasized the importance to the world of Portland Cement as a structural material and stressed the desirability of co-operative research in developing the full possibilities of this widely used structural material.

Where San Francisco Gets Its Water

MIDDLE portion of Hetch Hetchy reservoir with the water level almost up to maximum height (the white line shows the maximum height of water). Kolana Rock in the right foreground is about 1,500 ft. above the floor of the valley. The photograph shows the appearance of Hetch Hetchy Valley after the construction of the dam which is of considerable interest in view of the fact that the city's application for permission to construct this work was very vigorously opposed by nature lovers on the ground that this development would destroy the natural beauty of the region.

Dr. Luiggi Tells of Italian Engineering Activities

Many Technical Men in Legislature—Great Public Works Program to Develop South

From the position of purely technical business and of minor importance in public affairs a dozen years or so ago the engineer in Italy, as the result of organized effort, has become an important national figure. This condition of affairs is due in no small measure to the efforts of Dr. Luigi Luiggi, the eminent Italian engineer and honorary member of the American Society of Civil Engineers, who has journeyed to this country from Rome at the invitation of Rensselaer Polytechnic Institute to participate in the ceremonies at Troy, N. Y., tomorrow, which will mark the hundredth anniversary of the founding of that institution, a pioneer in the field of engineering education. On a number of topics of engineering interest Dr. Luiggi expressed his views in an interview with a representative of *Engineering News-Record* in New York this week.

Italian Engineers Licensed

For many years, Dr. Luiggi explained, Italian engineers have been seeking to place the profession, in the eyes of the public, on the same plane as that occupied by doctors, lawyers, and other professional men. Working through the Italian Society of Civil Engineers their efforts have culminated in the passage of a registration law for engineers which limits professional practice to those who are chartered by an examining board, the requirements being the equivalent of five years' study at a recognized engineering university in addition to a certain amount of practical work.

Asked if he could cite any tangible evidence of an increasing public appreciation of the engineer's position, Dr. Luiggi announced that the Italian Senate, of which he was elected a member at about the time of his arrival in the United States, includes thirty engineers in its membership of about 300 and the Assembly, or House of Representatives, forty engineers in a total of about 550 members. It is now the practice to include in the Italian national legislative bodies, according to Dr. Luiggi, certain specialists appointed for life terms; these include, in addition to engineers, doctors, agriculturists, bankers, manufacturers and others, so that in the case of proposed legislation affecting any profession or industry expert advice may be had within the government's councils.

Engineering, Dr. Luiggi reports, is gradually rising from the position of the lowest paid profession in Italy. Today it is the general practice for the designing and supervising consultant to receive a fee amounting to about 10 per cent of the cost of works involving an expenditure of 1,000,000 lira or less, while on larger-sized projects there is a sliding scale running to 5 per cent, or thereabouts. In general, the scale of remuneration for Italian engineers is showing a progressive increase year by year, although still much lower than that of other professional men, especially surgeons.

In governmental engineering service in Italy stress is placed upon promotion through the ranks to the higher positions. Only in rare cases is a department head or a chief of some special service brought in from outside the organization. In both the governmental and the provincial—equivalent to our state—engineering services a pension system is in effect. Pensions are payable when an engineer reaches the age of 65 years, or after he has served 40 years; then he is retired on full pay. If he reaches the age limit after 25 years of service, his pension amounts to one-half of his salary.

Against Strikes

With the advent of Mussolini as Premier and the growth of the Fascist movement in Italy great pressure of public opinion has been brought to bear to prevent industrial disputes. Under present conditions, Dr. Luiggi stated, there are no strikes or lockouts on construction or industrial work. Where differences of opinion do arise, provision is made for the settlement of the controversy before a magistrate after hearing evidence by committees representing the workers and the employers. This form of compromise, Dr. Luiggi pointed out, is purely voluntary, but is operative in practically all cases because Italian public opinion will not tolerate any action which results in halting present industrial activity. Out of a population of 40,000,000, Dr. Luiggi estimates that the unemployed total not more than 125,000, and many of these are absent from work due to malaria, which is a grave problem in the southern parts of the country.

Great Public Works Program

An era of great constructional activity is forecast by the distinguished Italian engineer. Under the guidance of Mussolini, to whose ability Dr. Luiggi pays high tribute, there is being put into operation in Italy a vast program of public works construction confined principally to the southern portion of the kingdom. The north of Italy has always been the richest section of the country and has profited by the expenditure of public funds in far greater degree than has the south, which is devoted mostly to agriculture. Premier Mussolini has decided to build up southern Italy by means of a great public works program with yearly expenditures of approximately 1,000,000,000 lira. These activities will take the form of improved road construction, drainage and irrigation, in addition to the development of water power. On road-building work a plan very similar to the federal-aid program of the United States will be used. On road construction in the southern provinces the government pays one-half, the province one-quarter, and the municipality the remaining quarter. In southern Italy large areas of land are rendered unproductive by the existence of marshes. These are to be drained and planted with wheat and other cereals. At present Italy produces only about two-thirds of the grain necessary for its own needs. With the marsh lands of the south reclaimed the country will be more than self-supporting as far as its supply of cereals is concerned. Another result that the drainage program will accomplish will be the stamping out of malaria, which has been one of the great deterrents to industrial and agricultural progress in the south. The drained marshes, in addition to producing wheat, will be utilized for growing beet sugar. The sugar industry is making rapid strides in Italy. All of this, Dr. Luiggi pointed out, means increasing responsibilities for engineers.

An interesting feature of the drainage projects is their joint financing by the federal government and private interests. On these works the actual construction operations are performed as private enterprises, but the cost is shared, 60 per cent by the Italian government and 40 per cent by the private company doing the development work.

On water-power developments the government also joins with private interests in financing the work. On many of the joint power plant developments the agreements provide for the payment by the government of 40 lira per horsepower per year for fifteen years. In return, 5 per cent of the power output of the station is available for governmental or municipal use at cost. Besides, after 60 years the hydraulic part—not the electric—becomes the property of the government, which can then let it to the private company at an annual rent.

Behind this large-scale public works program there is a carefully conceived plan which has for its main object the employment in Italy of Italian labor, which, in the days prior to present restrictions on emigration to America, left the kingdom at the rate of about 300,000 yearly. Today, according to Dr. Luiggi, there is work enough in Italy for everybody. In addition to the projects cited, another colossal engineering undertaking is the building of the Apulian Aqueduct, which will be 1,800 miles long and of which nearly three-fourths is already in operation.

Housing Shortage

Housing operations are extremely active in the larger cities, particularly in Rome. Here a special condition exists in that 1925 will be Holy Year. To the Vatican will come from all parts of the world pilgrims of the Catholic faith to the number of at least 100,000 a month. Rome's present population is about 600,000, so that there is at present great activity in providing ample housing facilities for next year's visitors. In addition to the building of new structures, additional stories are being placed on existing buildings.

An index of the stability of labor in Italy is afforded, according to Dr. Luiggi, by the fact that Henry Ford is now building with Italian labor both motor cars and tractors at a plant in Trieste, for export to points in the East, and the factory is thriving.

ENGINEERING EDUCATION

Far too many young men in Italy are enrolling in the universities for engineering courses, Dr. Luiggi said. Present registrations at technical schools indicate a supply of engineers at least double the demand. However, as these young men like to have a university training, it is better that they should become engineers than lawyers —as they otherwise would—as engineers are more useful in developing the natural resources of the country.

Himself a professor at the University of Rome, Dr. Luiggi was queried as to the capabilities of the present-day students. He finds their mentality lower than in pre-war days and their knowledge more superficial. They like too much sport, much more than is necessary for a "*mens sana in corpore sano.*" If the engineering graduates of the Italian universities are to measure up to those of a previous generation, he said, they must apply themselves more diligently to their studies than most of them are now doing. The engineering courses at the leading Italian universities now cover a period of five years.

DR. LUIGGI'S ACTIVITIES

After attending the ceremonies at the Rensselaer Polytechnic Institute this week, Dr. Luiggi will leave the United States Oct. 8 for Paris, to attend a conference on the Suez Canal on behalf of the Italian government. The Doctor is Italy's leading engineer. He has served as engineer-in-chief of the Royal Corps of Civil Engineers, and both in a public and private capacity he has been associated with many notable Italian engineering projects, particularly those involving harbor improvement. He was associated with engineering work on the new naval dockyard at Bahia Blanca in Argentine, also the harbor works of Montevideo and of Rio Grande do Sul in Brazil on which he gave advice together with Dr. E. L. Corthell some years ago.

At present Dr. Luiggi is professor of hydraulic and maritime engineering at the Royal University of Rome, in addition to being technical adviser to the Italian and Egyptian governments on a variety of engineering works. His latest honor, as noted at the beginning of this article, is his appointment for life as a member of the Italian Senate. A town of 10,000 inhabitants in the Pampas was named "Ingeniero Luiggi" by the Argentine government in recognition of his services to that country. Dr. Luiggi is an honorary member of the American Society of Civil Engineers, a member of the Institution of Civil Engineers of Great Britain, and holder of a number of honorary degrees and decorations from foreign governments. He served three terms as president of the Italian Society of Civil Engineers.

Study of Road Reinforcing Soon To Begin

Advisory Board on Highway Research Completes Initial Plans for Field Investigation

The details of plan and procedure to be followed in the investigation of the economic value of reinforcement in concrete roads, being undertaken by the Highway Research Board of the National Research Council, are now completed and field examinations are about to commence. Director Charles M. Upham reports that the various state highway commissions will actively co-operate with the board in conducting this investigation. Except in cases of actual failure, inspections will concern principally pavements having had at least five years of service, a great number of which are located in New Jersey, Ohio, New York, Pennsylvania, Delaware, Wayne County (Michigan), Milwaukee County (Wisconsin), Iowa, Illinois and California.

In this intensive study an effort will be made to determine from a survey of existing roads: (1) The influence of steel reinforcement on the resistance of the slab to traffic, subgrade, and climatic conditions; (2) the conditions under which steel reinforcement is especially beneficial to concrete slabs; (3) the effect of slab design on the efficiency of reinforcement; and (4) the relative cost of plain and of reinforced-concrete roads, considering the initial investment, the annual maintenance and renewal charges.

SCOPE OF INVESTIGATION

The procedure will consist of a personal examination of a sufficient number of existing road surfaces to cover different slabs, traffic, and climatic conditions. It is proposed to supplement the examination by photographs, sketches, soil determinations and other available data. In each case, attention will be given to a study of the subgrade to determine its general characteristics and properties as well as the existing drainage conditions. In the case of the slab, a study will be made of original data to determine the materials and proportions that entered into the concrete, the method of construction that was followed and the particular cross-section used. Careful note will be made of joints, cracks, replacement areas, and general surface conditions. The influencing factors of grade, alignment, location, and maintenance will be noted, and the matter of age, traffic, and climatic conditions will be given careful consideration.

In the case of the reinforcement, a study will be made of the relative amounts of longitudinal and transverse steel, the method of treating reinforcement before placing, as well as its position in the slab. The form of the reinforcement will receive consideration to determine the relative values of fabric, rods and other types in use. An effort will be made to determine the comparative value of hard steel and of mild steel for reinforcement, and the influence of continuous and non-continuous reinforcement. Wherever possible, the present condition of the reinforcement will be noted for breaks, rust, and other features of interest. Wherever obtainable, cost data will be secured covering the original as well as the maintenance investment.

The preliminary work of assembling data now available will soon be completed, at which time the field inspections will begin. The itinerary will be made out after further study, but it is proposed to pursue the investigation in the northern sections until cold weather, when attention will be turned to the southern locations.

It is expected that a progress report will be ready for the annual meeting of the Advisory Board on Highway Research to be held at the National Research Council building, December 4 and 5, 1924.

Railway Bridge and Building Convention Program Announced

For its thirty-fourth annual convention in Kansas City on Oct. 21-23, the American Railway Bridge & Building Association has arranged the following list of papers and reports: "The Inspection of Bridges," A. F. Robinson, bridge engineer, Santa Fe Ry.; "Fire Hazards of Treated Timber," C. S. Heritage, bridge engineer, Kansas City Southern Ry.; "Bridge Work of the Kansas City Terminal R.R.," J. V. Hanna, chief engineer; "Effect of Maintenance on Railway Bridge Design," John L. Harrington, consulting engineer; "The Bridge Building Department in a Railway Organization," L. W. Baldwin, president, Missouri Pacific Ry.; "History of the Eads Bridge at St. Louis," C. E. Smith, consulting engineer; "Smoke Jacks for Roundhouses," Maro Johnson, assistant engineer, Illinois Central R.R.; "Maintenance of Water Stations," O. C. Anderson, Southern Pacific Ry.; "Roofing Materials for Different Classes of Buildings," R. E. Caudle, assistant engineer of structures, International-Great Northern R.R.; "Handling Minor Jobs of Maintenance Work," T. G. Sughrue, supervisor of bridges and buildings, Boston & Maine R.R.; "Placing Concrete in Winter," F. P. Gutelius, Jr., division engineer, Delaware & Hudson R.R.; "Reduction of Accidents to Employees," D. Rounseville, assistant chief engineer, Chicago & Northwestern Ry.

Court Action Against Sewer to Protect Water Supply Ended

The borough council of Rockaway, N. J., has signed a contract permitting Jersey City to construct a trunk sewer through that borough to carry to a a point below the Boonton reservoir the sewerage of Wharton, Dover, Rockaway and Boonton. The sewer is already being built by the Hammen Construction Co. of Detroit, but thus far Dover is the only one of the four municipalities that is building laterals to connect with it. The Rockaway contract ends court proceedings brought to prevent the sewer being carried through that borough.

Bonds For Bridge Work Will Be Voted On At Portland, Ore.

Submission of a bond issue of $500,000 to the voters at Portland, Ore., for the completion of the Ross Island and Sellwood bridges has been agreed upon by the county commissioners, following the acceptance of a report which virtually fixed the height of the proposed Ross Island span at 120 feet above low water. The necessity for more funds than were provided for by the original bond issue arises largely from the fact that the Ross Island span will cost nearly $2,000,000 and the authorized bond issue was only $1,600,000. The Sellwood Bridge bond issue of $350,000 also has been found to be somewhat less than will be required.

A joint conference of city, county, dock, port and city planning commissions' executives accepted the report of the special committee of engineers setting forth the fact that the 120 foot height for a fixed bridge was the lowest which would receive undivided support and approval of the Secretary of War. The report was signed by four of the five engineers of the committee. H. H. Rode, representing Gustav Lindenthal, in charge of the County Bridge Program, did not sign it.

Oil Burns When Lightning Strikes "Tank Farm"

As the result of a bolt of lightning that struck one of six 55,000-gal. oil tanks at Monterey, Calif., on Sept. 14, a fire was started which not only destroyed the entire "tank farm" but caused the loss of two lives and extensive property damage.

The first tank to burn exploded when water in the lower part of the tank was converted into steam by the heat; as other nearby tanks were ignited a river of liquid fire flowed into Monterey Bay and, floating out into the water, continued to blaze with intense heat, consuming the fishing fleet at anchor and menacing piers and fish canneries along the shore. Fortunately the tide was on the ebb and complete destruction of buildings, railroad track, wharves, etc., was confined to the area directly in the path of the burning oil, about 20 acres.

U. of P. Requires More Practical Experience For Degrees

Graduate candidates for the degree of civil, chemical, electrical, and mechanical engineer from the Towne Scientific School, University of Pennsylvania, will have to meet much more strict requirements in order to obtain their degree than have been in effect in the past, according to a recent decision of the Board of Trustees.

Formerly such candidates were required to have had three years practical experience and to write a thesis on some phase of their branch of engineering, but under the new requirements the candidates must have seven years of practical experience, three of which must have been in responsible charge of work.

Utilization of Forest Products to Be Discussed

A conference to discuss utilization of forest products has been called by the Secretary of Agriculture, to be held in Washington, in the auditorium of the National Museum, Nov. 19 and 20. In his preliminary announcement the secretary says, "The question of timber supply is becoming more acute year by year. We are studying it from three angles: First, how to protect the timber we have from fire, insect pests, and plant diseases; second, how to encourage the growing of more timber, both on the national forests and private forests; third, how to cut down the waste in manufacture and use of wood."

The conference is called to obtain national recognition of the fact that better utilization of forest products ranks with forest protection and timber growing as one of the three essential elements of an effective forestry program, and to establish a nationally representative advisory committee to assist the Secretary of Agriculture in formulating and carrying out adequate measures to insure the most efficient development and use of our forests.

The secretary asks all interested associations and organized interests, whether lumbering interests, manufacturers using lumber or builders, to select delegates to represent them at the conference.

Niagara Falls Power Rent Fixed by State Commission

The New York State Water Power Commission, in an executive session held on Sept. 22, fixed the rental to be charged the Niagara Falls Power Co., for the diversion of water from the Niagara River in excess of 15,100 sec.ft. at 50 cents per horsepower. The water in excess of 15,100 sec.ft. which can be used under the present treaty amounts to 4,400 sec.ft.; the annual rental, therefore, will be approximately $45,000. The commission stipulated that rental was to be absorbed by the company itself and not passed on to consumers by an increase in rates.

The two applications of T. Kennard Thompson and Peter A. Foster, one for the development of 2,000,000 hp. in the Niagara Gorge at Foster Flats and the other for the development of 2,000,000 hp. in the Niagara River at Goat Island were both rejected, as was the application of the Moose River Power Co. for a license to develop 60,000 hp. on the Moose River. The commission is opposed, as a matter of policy, to the granting of any right to develop from the Niagara and St. Lawnerce Rivers to private interests.

Harbor Dredging at Providence

In an item in the Construction News pages of this journal, Sept. 18, p. 165, there was noted, under the general heading "Federal Government Work," the fact that there were 5,257,000 cu.yd. of material involved in dredging Providence Harbor. This statement was in error, according to the district engineer at Providence, R. I.; the amount is approximately 500,000 cu.yd.

Random Lines

The Peril of Dead Cats

"In consequence of their supply of taps not being properly labeled, many of the Liverpool householders are not sure whether they are drawing fluid from the main or the cistern. From the latter they may draw something they do not require. The Chairman of the Water Committee stated recently that the cistern water would be wholesome if the cisterns were cleaned out at short intervals, but in many cases the presence of a dead cat, a dead bird, or any other impurity might escape notice until the contamination of the water brought about a serious, if not a fatal, illness. He feared that owing to oversight of unskillful plumbing the taps drawing directly from the main were not indicated accurately in numerous dwellings, and it behooved all householders to inquire into a matter in which their own health was concerned. It is proposed to have all domestic taps labeled." From London *Municipal Engineering and Sanitary Record.*

* * *

Thanks for the Ad

"In the matter of seasonal construction, trade papers have taken a leading part in focusing attention on the possibilities that are afforded the industry by development of methods of winter work and better methods of obtaining off-season work. In the course of the survey it developed that a study of lost time in construction, which appeared in one magazine, stimulated a great deal of attention by engineers and contractors." From the report and recommendations of a committee of the President's Conference on Unemployment, entitled "Seasonal Operations in the Construction Industry—The Facts and Remedies."

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Two New Ones

The new Ritz Ballroom, at Fort Worth, Tex., announces that no expense has been spared in the effort to build the most beautiful ballroom in the South. In fact, it was designed and constructed by B. Martinez, of Chicago, "an amusement engineer of international reputation."

Oyster planters and culturists off Long Island aren't satisfied merely to be known as biologists. They are "biology engineers" according to one of them who has been interviewed by the *New York Times.*

* * *

Add Engineering Societies

A feature of this year's convention of the bakers at Atlantic City was the organization of the Society of Baking Engineers. Technical sections on Doughnut Hole Punching, Eclair Filling, and Jelly Roll Slicing are yet to be announced..

Control of Sewage Disposal Plans in Passaic Valley

That the Passaic Valley Sewerage Commission rather than the State Board of Health must approve plans for sewage disposal drawn for municipalities within the limits of the Passaic Valley Sewerage District is an opinion recently given by the attorney general of New Jersey in the case of plans submitted to the board by Ridgewood. The attorney general, addressing the board, said: "Undoubtedly the Legislature, in laying out the district, conferred upon the Passaic Valley sewerage commissioners exclusive jurisdiction over such matters within the limits of the district, and while you may perhaps approve plans submitted for a proposed sewage system, nevertheless your approval would not be final nor binding upon the Passaic Valley sewerage commissioners."

To Investigate Reservoir Failure at South Pasadena, Calif.

Failure of a water-works reservoir just completed for South Pasadena, Calif., will be investigated for the city by H. H. Hawgood and G. S. Binckley, consulting engineers, and Stanley Bent of Bent Bros., general engineering contractors, all of Los Angeles. The reservoir had just been completed and contained about 5 m.g. of water when it failed early on Aug. 31, flooding a residence and school building. The reservoir was partly in excavation, had a 20-ft. embankment and was lined with concrete, reinforced with wire mesh.

Safe to Increase Height of Dam

An opinion that it would be safe to raise the height of the Mountain Dell dam from 105 to 145 ft. and thus increase the reservoir capacity from 300 to 1,000 m.g., with a corresponding addition to the available water supply of Salt Lake City, is given in a report recently submitted to the city authorities by Fred A. Noetzli, consulting engineer, Los Angeles, Cal. The dam is of the multiple arch type.

Nashville Proposes $3,000,000 Bonds for Water Improvements

The Board of Public Works of Nashville, Tenn., proposes to submit to the electors on Nov. 4 a bond issue of $3,000,000 for water-works improvements. The project includes $750,000 for a filtration; $500,000 for a force main; $300,000 for a reservoir; $300,000 for a pumping plant; besides various main extensions and minor improvements.

Chairman of Canadian Railway Commission Appointed

Chief Justice H. A. McKeown, of the Supreme Court of New Brunswick, has been appointed chairman of the Board of Railway Commissioners of Canada to fill the vacancy created by the death of Frank B. Carvell.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburgh, Fla.; Annual Convention, Boston, Mass., Sept. 29-Oct. 3, 1924.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Rochester, N. Y.; Sept. 30 to Oct. 3.

AMERICAN CONSTRUCTION COUNCIL, New York City; Annual Meeting, New York City, Oct. 2-3, 1924.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York City; Annual Meeting, Detroit, Mich., Oct. 20-23, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Fall Meeting, Detroit, Mich., Oct. 23-25, 1924.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Washington, D. C.; Annual Convention, San Francisco, Calif., Nov. 17-20, 1924.

AMERICAN ROAD BUILDERS ASSOCIATION, New York City; Annual Convention, Chicago, Ill., Jan. 5-9, 1925.

ENGINEERING INSTITUTE OF CANADA, Montreal; Annual Meeting, Montreal, Jan. 27-29, 1925.

AMERICAN CONCRETE INSTITUTE, Detroit, Mich.; Annual Meeting, Chicago, Ill., Feb. 24-27, 1925.

Personal Notes

L. F. LOREE, president of the Delaware and Hudson Co. and chairman of the board of the Kansas City Southern Railway Co., has been honored with the Order of the Crown of Italy with the rank of Cavaliere. This distinction was awarded by King Victor Emanuel to Mr. Loree in recognition of the great value of his long-continued services to the engineering profession and to both the science and the business of railroading, especially as exemplified by his new classic treatise entitled "Railroad Freight Transportation."

BANCROFT HILL, harbor engineer of Baltimore, Md., resigned Sept. 15 to devote his time to private practice. FRANK W. MCKINNEY, assistant harbor engineer and formerly chief engineer to the Commissioners for Opening Streets, has been made acting harbor engineer. At a special meeting Sept. 26 a watch and an inscribed parchment were presented to Mr. Hill by the members and employees of the Harbor Board.

IVOR V. JONES, for the past four years with Lockwood, Greene & Co. as supervising engineer, and formerly a designing engineer on the Panama Canal, has recently become a member of the Structural Division of Stone & Webster, Inc., Boston, Mass.

F. E. HERMANNS, professor of structural engineering at Stevens Institute of Technology, has resigned. S. D. SNADER, who has been professor of structural engineering at the University of South Dakota, has taken his place. Professor Snader graduated from Ohio Northern University, in civil engineering, 1914, and received an M. S. degree from that institution in 1918.

H. S. WILLIAMS, city engineer of Santa Cruz, Calif., has resigned to accept a position with the California State Department of Public Works. HENRY GODEGAST, former assistant city engineer, has been appointed to fill the vacancy.

GEORGE J. GLOVER, general contractor, New Orleans, La., announces that he has incorporated his business under the name of the George J. Glover Construction Co., Inc., and that he is the president and general manager of this company.

Obituary

Dr. EDOUARD G. DEVILLE, director general of surveys in the Canadian Department of the Interior, died at Ottawa, Sept. 21, after a protracted illness; he was 74 years of age. He was born at Château du Loire, France, and, after a brilliant career in the French navy, where he was in charge of extensive hydro-electric surveys, came to Canada in 1864. He was for some time engaged in survey work for the Quebec government, afterward joining the survey staff of the Dominion government, succeeding Lindsay Russell as surveyor general. Dr. Deville held that position for thirty-one years, until two years ago when he was made director general of surveys. He established the system of Dominion land surveys and represented Canada on many international committees. He was the author of several important works, including "Astronomic and Geodetic Calculations" and "Photographic Surveying" and was a regular contributor to the Royal Society of Canada. In recognition of his public services he was appointed by King George as a Companion of the Imperial Service Order, and the University of Toronto accorded him the degree of Doctor of Laws. In 1922 he was made an honorary member of the Engineering Institute of Canada.

DAVID M. EARLE, city engineer of Worcester, Mass., died suddenly at his home, Sept. 29, of heart disease; he was 49 years of age. He was at one time a civil engineer at Penn Yan, N. Y., and Sea Cliff, L. I.

GEORGES F. E. DE GUERRY LANGUEDOC, formerly chief engineer of the Public Works Department at Ottawa, Canada, died Sept. 19 at his home there. Mr. Languedoc assisted in the survey of the Pontiac Line and the Georgian Bay Ship Canal, and supervised the construction of the Port Arthur dry docks.

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Mixer Manufacturers Form New Organization

Affiliate With A.G.C. — Plan to Collect Statistics on Sales—Technical Committee Named

Prominent manufacturers of concrete mixers, meeting in Milwaukee, Sept. 12, perfected the organization of an affiliated bureau of the Associated General Contractors of America by electing George C. Ellis, of the Ransome Concrete Machinery Co., Dunellen, N. J., chairman of the group and W. B. Simpler, of the Jaeger Machine Co., Columbus, Ohio, secretary-treasurer. This is the first group of construction equipment manufacturers to perfect a bureau to function in co-operation with and through the Associated General Contractors. Several other groups of equipment and material producers have the subject under consideration.

Ten Companies Join

Ten companies manufacturing concrete mixers joined the bureau and two others indicated their intention of joining as soon as authority from their directors could be secured. The concrete mixer manufacturers, as a bureau of the A.G.C., decided to report to that organization at the close of the year total sales of mixers for 1924 by type and value, and after Jan. 1 to report monthly, the aggregate statistics to be issued by the Associated General Contractors to members of the bureau only. Production and stocks will not be reported according to the present intention, although the statistical work which the bureau will request of the A.G.C. has not been fully decided.

The Mixer Bureau agreed to the standards of capacity proposed some months ago by the Associated General Contractors for concrete mixers. Each machine produced under this agreement will bear a plate supplied by the A.G.C. specifying its capacity and standard parts.

Technical Committee

The bureau named a Technical Committee comprising E. Lichtenberg, of the Koehring Co., Samuel Shafer of the Chain Belt Co., and George T. Schniat, of the Remmel Manufacturing Co., and provided for an executive committee to be named from representatives of five manufacturers. Gen. R. C. Marshall, Jr., general manager of the Associated General Contractors, represented that organization at the Milwaukee meeting.

Omaha Road Equipment Co., Omaha, Neb., has been appointed by the Holt Manufacturing Co., Peoria, Ill., as distributor for its Caterpillar tractors. C. E. Miller is president of the Omaha company.

Steel Reinforcing Bar Sizes

To the Editor:

The writer personally is very much in sympathy with the suggestion outlined by William H. Adams in your issue of Sept. 11, p. 445, whereby reinforcing bars shall be rolled in sizes differing from each other by a constant area, with the bar designated in such a manner that its name (or number) would indicate immediately its area in square inches. There is but little question that a system of this kind would simplify the work of design and construction, but the change involved is quite radical and would have to be undertaken gradually from a manufacturing standpoint.

The suggestion has been made before and has been objected to by both engineers and constructors, generally on the grounds that it "never had been done before."

It is true, however, that ultimately the buyer can have whatever he demands, and if the point in question is stressed sufficiently before the Division of Simplified Practice of the Department of Commerce, it would certainly be given every consideration.

Alex. Thomson, Jr.,
New York — District Sales Manager,
Sept. 23. — Concrete Steel Co.

Mexico Important United States Machinery Market

The Mexican market for industrial machinery is principally in American hands, exports from the United States amounting to over 80 per cent of the total, according to report to the Department of Commerce by Assistant Trade Commissioner H. B. MacKenzie, Mexico City. Germany is the closest competitor of the United States with exports to Mexico ranging from $1,300,000 to $2,150,000 during the past four years, though American exports have varied from $8,000,000 to over $30,000,000 during the same period. In spite of prevailing commercial depression since 1920 the Mexican machinery market has shown consistent expansion. In the year 1923 Mexico was the fifth largest export market of the United States for industrial machinery and in 1922 the fourth. In 1921 Mexico occupied first position in this trade and in previous years has ranged from second to fifth place. There is no manufacturing of machinery in Mexico and practically all machinery shipped from other countries is imported free of duty.

Germany supplies an appreciable share of the internal combustion engine requirements of Mexico. German pumps, oxygen plants, and arc-welding apparatus are also in demand.

United States exports of industrial machinery fell off to the value of nearly a million dollars in 1923 from the 1922 figures. Mining and pumping machinery continue to be our most important item in this classification, 1923 figures recording sales amounting to $2,488,823. Power-generating machinery, except electric, sales were valued at $1,042,695. There are a number of American machinery houses in Mexico City acting as representatives of American machinery manufacturers, employing salesmen who canvas the entire republic and the services of one of these houses is preferable to one of the larger number of German firms in the capital which handle competing lines of German-made machinery, advises Mr. MacKenzie.

Paving Brick Shipments Higher in August

August was a busier month than July in the street paving field if shipments of paving brick during that month are to be taken as a criterion. August shipments were 32,400,000 brick as against 31,300,000 for July, according to the regular monthly report of the National Paving Brick Manufacturers Association to the United States Department of Commerce.

With 22 companies reporting for the month as against 24 companies for the previous month, the actual shipments for the entire industry were much in excess of this number. The companies reporting for August represent 59 per cent of the normal tonnage capacity of the industry. They reported production for the month at 74 per cent of their normal monthly capacity.

Production declined from 31,452,000 for July to 26,569,000 for August. Unfilled orders at the end of August were 76,867,000 for the 22 companies. This figure is higher than usual for this time of year, and this is taken to indicate a busy fall and early winter season, as well as an early start on the new year's paving programs.

Business Notes

Dr. Maximilian Toch, vice-president of Toch Brothers, Inc., New York, returned to America on the *Leviathan* Sept. 22. He left New York last February at the invitation of the Chinese Government, having been appointed Honorary Professor of Chemistry, to deliver a series of lectures at the Peking Technical College at Peking, China. On the completion of these lectures he was given the degree of Doctor of Science by the Chinese Government, and several other honorary degrees were conferred on him for his services. While abroad he made a thorough investigation of the wood oil situation, having visited the various plants at Hankow and other points. He was among the first to introduce this commodity to the paint and varnish industries some thirty years ago. After leaving China Dr. Toch visited Italy, Czecho-Slovakia, France, Brussels and England.

T. L. SMITH Co., Milwaukee, manufacturer of concrete mixers and pavers, announces the appointment of M. B. Rider, formerly of the Northwest Engineering Co., as manager of the New York office at 50 Church St. The Ginsberg-Penn Co. no longer represents the T. L. Smith company in the New York territory.

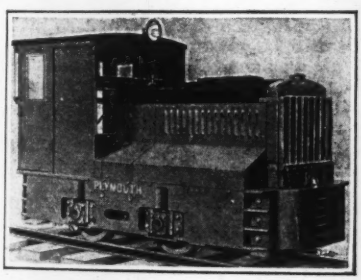
HENRY DISSTON & SONS, INC., Philadelphia, have begun the operation of their branch factory in Seattle, just completed. The new plant, it is claimed, carries the largest finished stock on the Coast of circular saws, band saws, crosscut saws, machine knives, files, steel and saw tools for immediate shipment. The plant is equipped for manufacturing saws to meet the special requirements of Western mills, and also for repairing saws of all types. It is equipped to cut down, grind, hammer, and retooth all styles of circular saws, repair projections on inserted-tooth saws, and retooth, braze, and piece band saws of every gage. The company's other distributing points on the Pacific Coast include San Francisco, Portland, Los Angeles, and Vancouver, B. C.

SUTHERLAND G. TAYLOR, export manager of the Holt Manufacturing Co., New York, died recently.

Equipment and Materials

New 8-Ton Industrial Locomotive

To its line of industrial gasoline locomotives the Fate-Root-Heath Co., Plymouth, Ohio, has added a new 8-ton model of the four-speed gear-driven type. The equipment of this locomotive includes a Climax gasoline engine developing 65 hp. at 900 r.p.m., Bosch high-tension magneto with impulse

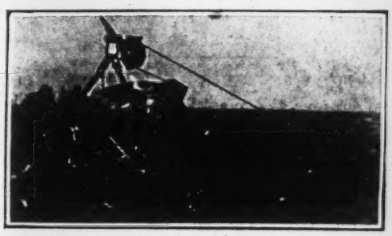


coupling, Simms 12-volt starter, Willard storage battery, Stromberg carburetor, and United air cleaner and built-in governor. Cooling is done by a Modine sectional radiator and 22-in. gear-driven fan.

This locomotive is built with a high cab (84 in. overall) enabling the operator to see over industrial cars. To avoid the danger from an exit between the locomotive and the car behind it, the cab is provided with a side entrance equipped with sliding steel doors. Axles are of alloy steel 4 7/16 in. in diameter. All four wheels are equipped with brakes of the lever type. The speeds are 2½, 4, 8, and 12 miles per hour, while the draw-bar pulls are 6,000 lb. (with sand) at 2½ miles per hour; 4,800 lb. (with sand) at 4 miles per hour; 4,000 lb. (without sand) at 4 miles per hour; 2,400 lb. at 8 miles per hour, and 1,600 lb. at 12 miles per hour.

Dragline Bucket With End Gate

In the new dragline bucket developed by the Page Engineering Co., Chicago, the special feature is a door or end gate hung forward of the cutting edge. As this door closes on the outside of the bucket the capacity of the bucket is much larger than it would be with an inside gate, while it avoids side plates or straps attached to the inside of the bucket and likely to get out of order.



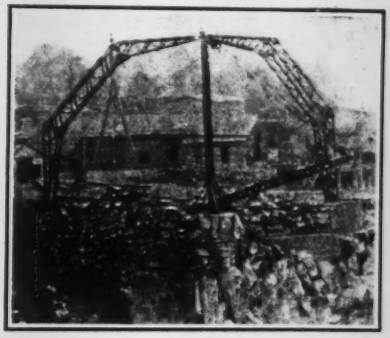
With the door closed, no material is lost when swinging the load.

With the point of attachment of the pulling bail at the forward end of the gate, the first pull of the dragline opens the gate and tips the bucket to its initial digging position. The usual dump line, which also serves as a closing line for the gate, is attached at one end to the drag cable and on the other end to an arm on the back of the gate after passing over a sheave attached to the hoist bail and also over another sheave at the top of the hood. By retaining some tension on the drag cable when the bucket starts to hoist, a powerful closing action, similar to that in a clamshell bucket, is exerted on the door. A dump cable directly connected from the end gate to the hoisting bail pulls the door wide open when the excavated material is to be dumped.

As the bucket is hoisted the door is closed automatically, and in dumping the door is opened automatically to its widest position. No moving parts come in contact with the material being excavated, thus insuring durability. The actual capacity of the bucket is said to be increased 22 per cent by the door arrangement.

Derrick with Arched Supports

A 20-ton steel derrick with curved stiff-leg members supporting the mast and permitting a full-circle swing of the boom has been built by the American Hoist & Derrick Co., St. Paul, Minn., for the Montello Granite Co., Montello, Wis. The 60-ft. mast carries a 50-ft. boom which can be swung in a horizontal position, the clear span between the mast and the legs of the supporting arch members being 54 ft. In plan, these two members are at right angles to each other. In other steel derricks of the full-circle swing type built by the same company for this quarry and for similar work, each stiff-leg consists of a vertical A-frame and an inclined box-lattice member extending from the head of the A-frame to



the head of the mast. In all these derricks the masts and booms are of box-lattice construction.

Publications from the Construction Industry

Portable Air Power—INGERSOLL-RAND Co., New York, has collected in a 72-p. illustrated booklet, entitled "100 and 1 Ways to Save Money with Portable Air Power," information showing the varied uses of portable air compressors and pneumatic tools operated by them. In a number of the cases cited cost data are given comparing hand versus machine methods. The text shows typical uses of portable compressors by public service companies, municipalities, general contractors, road builders, steam and electric railways, and factories. Examples are given of the use of such tools as paving breakers, jackhammers or hand hammer drills, mounted rock drills, trench and clay diggers, backfill tampers, pneumatic hoists, tie tampers, riveters, calking hammers, sand blast equipment, paint sprays, cement-gun equipment, and drill steel heating and sharpening equipment.

Colored Concrete Hardener—MASTER BUILDINGS Co., Cleveland, in a 16-p. illustrated pamphlet, describes the uses of Colormix for hardening, waterproofing, and coloring concrete floors. Instead of being a dry color, mixed with the sand and cement, Colormix acts as a dye to the gaging water. The scale of colors includes eight shades—red, French gray, battleship gray, brown, green, buff, white, and black. Floors in which this material is used are suitable for residences, terraces, porches, billiard rooms, laundries, basements, swimming pools, conservatories, and miscellaneous landscape work. Other typical uses are in schools, hospitals, hotels, clubs and commercial buildings. The pamphlet contains detailed specifications for the use of Colormix.

Unit Heaters—BUFFALO FORGE Co., Buffalo, N. Y., presents data for the factory manager and small shop owner regarding the use and advantages of unit heaters in a bulletin describing Breezo-Fin heaters. The text is illustrated and includes tables of capacities and dimensions. The bulletin discusses the question of temperature control in general and presents and describes the services of the company.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Lumber Price and Production Below Year Ago

As measured by reports to the National Lumber Manufacturers' Association from 364 of the chief commercial softwood lumber mills of the country, the lumber movement decreased slightly during the week ended Sept. 20 as compared with the week preceding.

Production, shipments and orders were also considerably under the corresponding period in 1923.

The following table compares the national lumber movement, as reflected by the comparable reports from mills of seven regional associations, for the three periods indicated:

	Week of Sept. 20 Ft.b.m.	Corresponding Week in 1923 Ft. b.m.	Preceding Week 1924 Ft. b.m.
Mills	364	396	367
Production	227,439,688	264,316,994	228,187,229
Shipments	222,161,194	242,529,867	224,925,058
Orders	224,719,143	245,871,632	225,250,709

Figures comparing the lumber movement for the first thirty-eight weeks of 1924 with the same period last year, are as follows:

	Production Ft. b.m.	Shipments Ft. b.m.	Orders Ft. b.m.
1924	8,893,165,548	8,808,633,847	8,547,551,541
1923	9,261,705,347	9,289,399,813	8,781,846,861
1924 Increase	368,539,799	480,765,966	234,295,320

The lumber price situation is following somewhat the same trend as production, in the current market. Of nine cities reporting weekly to *Engineering News-Record*, all but two registered no price changes during the week ended Sept. 20. Seattle announced an advance of $2 per M ft. in Douglas fir timbers. New York registered a $2 decline in l.l. yel. pine. Compared with the corresponding period in 1923, however, all cities reported declines with the exception of Dallas, which showed a rise of $4.95 per M.ft. b.m. The following table shows the price situation during the same periods for which production statistics are given above, prices cover structural timbers, 3x12 to 12x12, 20 ft. lengths and under per M. ft. b.m., f.o.b.:

	Week of Sept. 20	Corresponding Week in 1923	Preceding Week, 1924
New York (pine)	$51.00	$56.00	$53.00
Atlanta (pine)	35.00	40.00	35.00
Dallas (pine)	57.20	52.25	57.20
Chicago (pine)	55.00	58.50	55.00
Minneapolis (fir)	37.75	46.75	37.75
Denver (fir)	34.75	44.25	34.75
San Francisco (fir)	29.00	38.00	29.00
Seattle (fir)	26.00	29.00	24.00
Montreal (pine)	60.00	70.00	60.00

Bids Wanted on Big Job

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 181 to 195, is the following:

Store, Newark, N. J., for the L. S. Plaut & Co., $5,000,000.

Business Briefs

Call money quoted at 2@3 per cent, Sept. 29.

Time loans; short periods, 2½@2¾ per cent; longer terms, 3@3¼ per cent.

Foreign exchange (Demand):

	Normal	This Week	Last Week	Year Ago
Sterling	$4.8665	$4.44¾	$4.46	$4.53¾
Franc	.193	.0524	.0529½	.0593½
Lira	.193	.0437½	.0438¼	.0448¼

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 181 to 195, are the following:

Terminal warehouse, Bethlehem, Pa., for Lehigh and Northeast Terminal Warehousing Co., to Cramp & Co., $1,000,000.

Dock, Superior, Wis., for the Great Northern Railway, to Barnett & Record Co., Duluth, Wis., $1,000,000.

A New Normal for Industrial and Commercial Building

In 1913 industrial building contracts of $25,000 and over totaled $49,000,000. From 1916 to 1920 they averaged $326,000,000, the peak being ten times the 1913 total.

That the momentum which the war gave to industry in general has not subsided is shown by the industrial building record in the last four years. The average has been four times the 1913 figure. This year's value will reach $225,000,000, according to *Engineering News-Record* figures.

Much the same thing has happened in the case of commercial building—offices, hotels, warehouses, etc. The average for the years 1913 to 1918 was $175,000,000. Since then there has been a tremendous acceleration. The annual values are:

1919	$352,000,000
1920	351,000,000
1921	568,000,000
1922	751,000,000
1923	839,000,000
1924	950,000,000

Contracts for commercial buildings, published in Construction News—

1913 . . . $149,000,000
1923 . . . 839,000,000
1924 . . . 950,000,000 (est.)

Details will soon be published in this section.

Structural Steel Sales Fewer

The U. S. Department of Commerce announces sales of fabricated structural steel for August, based on figures received from the principal fabricators, as 59 per cent of capacity, with total bookings of 137,400 tons reported by firms with a capacity of 234,170 tons per month. Shipments of firms reporting this item represented 73 per cent of capacity as against 81 per cent in July.

BOOKINGS OF STEEL STRUCTURALS

	Actual Tonnage 1924	Actual Tonnage 1923	Per Cent of Capacity 1924	Per Cent of Capacity 1923
January	175,639	179,337	72	72
February	179,866	192,270	73	77
March	174,465	229,733	71	92
April	159,254	193,639	65	78
May	145,430	140,558	59	56
June	161,525	125,531	66	50
July	167,564	125,105	69	50
August	137,400	143,402	59	57

Lumber Bids on Wilson Dam Project

Bids on various descriptions of pine lumber used in the construction of the Wilson Dam in the Tennessee River are shown in the accompanying tabulation. The three lowest bidders and the successful contractors are also given. In the bids tabulated here, the contract was awarded to the lowest bidder in each case. In a similar arrangement of lumber bids on the same project, as published in *Engineering News-Record*, issue of Sept. 4, p. 402, the contract was let in a number of instances to the highest bidder, delivery conditions governing the award.

PINE LUMBER BIDS ON WILSON DAM CONSTRUCTION

Bids Opened	Description of Material	Three Low Bidders	Amount	Contract Awarded to
Aug. 23	225,000 ft. l.l. Southern yel. pine, No. 1 com., S4S, 1-in. x 8, 10 and 12-in., 12, 14 and 16 ft.	Cleveland Lumber Co., Jasper, Ala.	$8,662	Cleveland Lumber Co.
		Gilchrist-Fordney Co., Laurel, Miss.	8,775	
		R. J. McCreary, Evergreen, Ala.	9,455	
Aug. 29	175,000 ft. virgin l.l. Southern yel. pine, air dried, No. 1 com., S4S, 2-in. x 6 and 10-in., 12, 14, 16 and 18 ft.	Kane Lumber Co., Birmingham, Ala.	5,115	Kane Lumber Co.
		Ed Hines Yel. Pine Co., Lumberton, Miss.	5,843	
		Hull Lumber Co., Laurel, Miss.	5,851	
Aug. 30	287,000 ft., short leaf, Southern yel. pine, No. 1 com., rough, timbers.	M. M. Elledge Lumber Co., Cornith, Miss.	6,490	M. M. Elledge Lumber Co.
		Acme Lumber Co., Birmingham, Ala.	6,512	
		Cleveland Lumber Co., Jasper, Ala.	6,556	
Aug. 30	100,000 ft. short leaf Southern yel. pine, No. 1 com. 160,000 ft. virgin l.l. Southern yel. pine, close grain, air dried, No. 1 com. All 2-in. x 6, 8 and 10 in., 12, 14 and 16 ft., S4S.	Kanley Lumber Co., Birmingham, Ala.	5,115	Kanley Lumber Co.
		M. M. Elledge Co., Cornith, Miss.	5,449	

Actual Volume of September Construction Heavier Than Preceding Month

New England and Middle Atlantic States Lead—Gains in Streets, Roads, Excavations and Industrial Buildings

September contracts awarded on large engineering construction projects amounted to $161,132,000 as compared with $163,292,000 for the month preceding and $173,072,000 during September, 1923.

Minimum costs observed in the Construction News section of *Engineering News-Record* in each class of construction are as follows: Water-works and excavations, $15,000; other public works, $25,000; industrial construction, $40,000; and commercial buildings, $150,000.

September lettings were particularly heavy in streets, roads, industrial construction, excavations, drainage and irrigation projects.

Among the large contracts let during September were the following projects:

Hotel, Chicago, Ill., $7,000,000; hotel, Columbus, O., $4,000,000; courthouse, New York, N. Y., $3,600,000; club, Philadelphia, Pa., $3,500,000; power plant, Providence, R. I., $2,500,000; manufacturing plant, Baltimore, Md., $2,000,000; store, Milwaukee, Wis., $1,500,000; library, Los Angeles, Calif., $1,353,000; apartment, Cambridge, Mass., $1,200,000.

Engineering News-Record Construction Cost Index Number

October, 1924	207.55
September, 1924	211.25
October, 1923	220.30
Peak, June, 1920	273.80
1913	100.00

Jan., 1923	191.70	Nov.	220.90
Feb.	197.40	Dec.	217.30
Mar.	205.25	Jan., 1924	217.90
Apr.	213.50	Feb.	220.30
May	216.70	Mar.	224.70
June	220.70	Apr.	221.60
July	222.10	May	222.38
Aug.	221.50	June	216.85
Sept.	221.50	July	214.40
Oct.	220.30	Aug.	213.15

Engineering News-Record's Construction Cost Index Number declined 3.7 points since last month, owing to lower steel and lumber prices. The average rate for common labor is still 56c. per hr., against 55c. six months ago and 54c. in October, 1923. Thus general construction cost is 6 per cent lower than one year ago and 32 per cent under the peak; it is 107 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

September, 1924	(4 issues of E. N.-R.)	135
August, 1924	(4 issues of E. N.-R.)	134
September, 1923	(4 issues of E. N.-R.)	137

Entire Year

1923	135
1922	130
1921	88
1920	91
1919	91
1918	80
1917	64
1916	97
1915	95
1914	104
1913	100

Engineering News-Record's Construction Volume Index Number is 135 for the month of September, and 135 for the whole of 1923, as against 100 for 1913. This means that the actual volume of construction in 1923 (not the mere money-value of the contracts let that year) is 35 per cent above the volume of construction for 1913. Our monthly volume number, 135 for September, 1924, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

VALUE OF CONTRACTS LET IN THE UNITED STATES AND CANADA DURING SEPTEMBER, 1924

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Western	United States	Canada	Grand Total
Waterworks	$250,000	$644,000	$809,000	$1,435,000	$1,213,000	$769,000	$5,120,000	$218,000	$5,338,000
Sewers	176,000	2,650,000		1,242,000	746,000	1,081,000	5,895,000	49,000	5,944,000
Bridges	104,000	1,113,000	295,000	287,000	1,845,000	895,000	4,539,000	77,000	4,616,000
Excavation, drainage, etc.	480,000	48,000			2,574,000	15,000	3,117,000	464,000	3,581,000
Streets and Roads	2,889,000	7,455,000	8,982,000	6,032,000	10,026,000	5,458,000	40,842,000	3,743,000	44,585,000
Industrial Bldg.	5,955,000	3,845,000	1,145,000	2,830,000	1,744,000	1,228,000	16,747,000	200,000	16,947,000
Commercial Building	10,331,000	17,653,000	2,110,000	23,040,000	10,793,000	7,843,000	71,770,000	310,000	72,080,000
Federal Government	34,000	277,000	190,000	60,000	1,232,000	334,000	2,127,000		2,127,000
Unclassified	156,000	425,000	343,000	83,000	1,778,000	77,000	2,852,000	3,052,000	5,914,000
September, 1924	$20,375,000	$34,110,000	$13,874,000	$35,009,000	$31,951,000	$17,700,000	$153,019,000	$8,113,000	$161,132,000
August, 1924	15,231,000	25,636,000	15,789,000	40,611,000	34,320,000	26,798,000	158,385,000	4,907,000	163,292,000
July, 1924	15,296,000	70,646,000	27,811,000	50,847,000	22,747,000	11,932,000	199,279,000	2,816,000	202,095,000
Total 3 months	$50,902,000	$130,392,000	$57,474,000	$126,467,000	$89,018,000	$56,430,000	$510,683,000	$15,836,000	$526,519,000

Labor Rates and Conditions Throughout the Country

Employment in the basic industries has shown more activity during the past two weeks than at any time since June. There were also marked increases in average weekly earnings and average hours of work per week, according to the U. S. Department of Labor.

In the manufacturing industries wage advances are in excess of the declines, as in the case of twenty-two of the most recent wage adjustments.

Of the twenty-two mentioned, twelve were increases and ten reductions. Eight of the increases occurred in the leather industry and eight of the reductions, among textile workers, according to the National Industrial Conference Board.

According to the Board's index number, the recent slight rise in the cost of living was occasioned by higher food and clothing prices. Average hourly earnings in twenty-three manufacturing industries are about 127 per cent above the 1914 level, while rents have increased 86 per cent since then.

The construction industry, however, shows no unemployment except that of a purely seasonal nature. The same holds true of the building materials manufacturing industries.

Building trades wages appear to be nearer a condition of stabilization now than at any time during the past ten years, judging from the gradual decline in the number of wage adjustments occurring in the cities reporting regularly to *Engineering News-Record*.

That the building boom is by no means broken is shown by the following totals of contracts let, as published in the construction News Section of *Engineering News-Record*.

Jan. 1 to Oct. 1, 1924	Jan. 1 to Oct. 1, 1923
$614,320,000	$562,983,000

These totals include large engineering construction projects only, and do not touch commercial buildings below $150,000. From these figures, however, it is evident that 1924 may even eclipse the record year 1923.

Local conditions as reported to *Engineering News-Record* follow:

Chicago—Painters increased 25c. per hr., making the present rate $1.50. This places painters, bricklayers, plasterers, steamfitters and electricians all on the same wage basis.

Cleveland—Employment on increase, particularly in automobile and metals industries.

Detroit — No proposed changes in current wage scales in any of the construction trades. No shortage of help in any craft. Numerous large projects now under way; not so many, however, in immediate prospect.

Montreal—Surplus of common un-

CURRENT BUILDING TRADES WAGE RATES PER HOUR

(Higher rates indicated by +, decreases by —)

Cities	Brick-layers	Car-penters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.30
Baltimore	1.75	.90@1.20	1.00@1.12½	1.00	$0.65	1.12½	40
Birmingham	1.00@1.50	.25@.75	.75@1.00	.35@.45	.....	1.00	.25@.40
Boston	1.25	1.00@1.10	1.25@1.35	.82½	1.05	1.25	.55@.75
Cincinnati	1.50	+1.25	+1.25	.92½	+1.25	+1.25	.55
Chicago	1.50	1.15@1.25	1.10@1.25	+1.00	1.25	1.25	.75@.82½
Cleveland	1.50	1.25	1.25	.87½	1.00	1.37½	.87½
Dallas	1.50	1.00	1.00	.40@.75	.87½	1.00	+.45@.60
Denver	1.62½	1.12½	1.12½@1.18¾	.81¼@.87½	1.00	1.15⅝	.35@.55
Detroit	1.50	.90@1.00	.85@1.00	.90	.85@1.00	1.12½	.60@.75
Kansas City	1.37½	1.25	1.00@1.25	.90	1.00@1.12½	1.00	.40@.65
Los Angeles	1.25	+87½@1.00	.87½@1.00	+1.00@1.12½	.75@.87½	+.87½	.50
Minneapolis	1.12½	.87½	.87½	.71½	.....	.87½	.50@.55
Montreal	1.00	.65	.62½	.45	.50	.65	+.30@.35
New Orleans	1.25	.90	1.00	.65	.80	1.00	.35@.40
New York	1.50	1.31¼	1.50	1.00	1.00@1.12½	1.31¼	.62½@.75
Philadelphia	1.50	1.12½	1.02½	1.12½	1.00	1.12½	.40@.45
Pittsburgh	1.55	1.37½	+1.12½@1.37½	1.00	.....	1.37½	.70
St. Louis	1.75	1.50	1.50@1.67½	1.15@1.25	1.25	1.50	.45@1.10
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.25	1.00	1.00@1.12½	+1.00	1.00@1.12½	1.12½	.62½

skilled laborers for building operations.

New York—Hoisting engineers have returned to work under the old terms, after having been out on a strike in sympathy with the structural iron workers, who have not yet settled differences with employers.

Pittsburgh—Plasterers on strike as result of differences with terrazzo workers' union. Action of the plasterers has tied up several large construction projects. Otherwise, employment in the Pittsburgh district is now more active than it has been at any time since June.

St. Louis—The charter of the Building Trades council has been officially restored by the American Federation of Labor, following the settlement of a dispute which resulted in the suspension of the Council on Sept. 27, 1923. The trouble started with the refusal of the Council to unseat delegates from the dissenting Ironworkers' Union.

San Francisco—Employment still active particularly in the building trades.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Downward Trend in Prices, Started Five Months Ago, Is Still in Evidence—No Sudden Revival of Buying Has Materialized

Pig-Iron—Market quiet with buying confined to small lots. No accumulation of reserve stocks. No 2 f'dry, Southern, is $18@$18.50 per ton, Birmingham. Price level about 50c. per ton above month ago and $4.50 to $5 per ton below a year ago.

Railway Supplies—Railway steel represents the leading item in current steel demand. Light rails, ties, track bolts and section angle bars, firmer than a month ago.

Pipe—Owing to abolition of the Pittsburgh Plus system, wrought steel pipe will have two basing points namely: Pittsburgh and Wheeling district and Lorain, O. Cast-iron pipe, 6-in., dropped $1 in St. Louis $2 in San Francisco and $4 per ton in New York and Pittsburgh during month. Clay-drain tile has advanced slightly in the West. Sewer pipe advances balanced by declines.

Road and Paving Materials—Firmness reported in road oils in the West and wood blocks in the Eastern states. Slight downward trend in paving stone. Of nineteen cities reporting regularly to *Engineering News-Record* but two, Philadelphia and Seattle, show any price changes in asphalt. The former dropped $2 and the latter $2.50 per ton on package asphalt. September road contracts were $4,000,000 ahead of the month preceding for the U. S. and Canada together.

Sand, Gravel and Crushed Stone—No changes reported in sand. Gravel and crushed stone slightly firmer in New England. Great volume of crushed stone being moved in New York district; prices firm at present levels.

Lime and Cement—Common lump quoted at $2.50@$3 per bbl. (280-lb. net) in New York City, against $3@$3.25 at this time last year. Firmness in lump and hydrated, however, reported in New England. Cement prices, although below the level of a year ago, have not changed recently in forty-six important centers throughout the country.

Brick and Hollow Tile—Brick has not changed in the New York market from $17 per M., delivered, since last month. One year ago, however, the price was $23.65. Brick rose slightly in Boston and Dallas, since Sept. 4. Aside from a slight decline in the Dallas district, no other changes in hollow tile were reported during the month.

Structural Steel — Trend of steel prices continues downward. Wire products, steel sheets and wrought pipe are the principal items affected by the abolition of the Pittsburgh Plus. Reinforcing bars are now $2@$2.10 per 100 lb. Pittsburgh; shapes, $1.90 @$2; and plates, $1.60@$1.90. Maximum on bars is about 5c. per 100 lb. below a month ago; that of plates about 10c.; and shapes, 15c.

Lumber—Despite general falling off in demand, price advances are in excess of declines, compared with a month ago. Most of the advances in pine, fir, hemlock and spruce occurred in the Western states; increases balanced declines in New England, and the Middle Atlantic section showed a decided downward trend. Pine demand is better in the section south of the Georgia-Carolina area while there is a slight strengthening of buying in fir, common, in the Minneapolis district.

Iron and Steel Scrap—Heavy melting steel advanced 50c. per ton in New York during month.

Linseed Oil—Raw oil quoted at $1.03 per gal. (5-bbl. lots) f.o.b. New York, against $1.07, one month ago and $0.95 in October, 1923. Similar declines in Atlanta and Minneapolis.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	Oct. 2	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	$22.05@22.55	$27.05
Northern Basic	20.00	25@26
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	21.77	25.50
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	28.05	30.00
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	18.00@**18.50**	23.00
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	*21.77@22.77*	26.25
Virginia No. 2 (silicon 2.25 @ 2.75)	28.44@29.44	30 17
Basic	20@21	26 00
Gray Forge	21.22	25.00
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	20.00	26.00
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	*25.05*	29.01
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	*22.77*	26.77
Basic	*22.77*	26.77
Bessemer	*25.26*	27.77

SCRAP—The prices following are per gross ton paid to dealers and producers f.o.b. New York. In Chicago the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	Birmingham
No. 1 railroad wrought	$14.00	$11.50	10.00@11.00
Stove plate	10.00	12.00	14.00@15.00
No. 1 machinery cast	14.00	16.50	14.00
Machine shop turnings	8.00	4.00	6.00@7.00
Cast borings	9.00	5.50	8.00@9.00
Railroad malleable	13.00	12.50	13.00
Re-rolling rails	14.00	13.00	15.00@16.00
Re-laying rails	22.00	30.00	23.00
Heavy melting steel	**12.00**	.....	.....

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	Oct. 2	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43@45	$43.00	$43.00	$46.00
Standard openhearth rails	43.00	43@45	43.00	43.00	46.00
Tight rails, 8 to 10 lb.	38@**39**	43@45	2.00*	40.00	**2.55***
Tight rails, 12 to 14 lb.	38@**39**	38@40	2.00*	40.00	*2.35**
Light rails, 25 to 45 lb.	37@38	.....	2.00*	40.00	*2.10**
Rerolled Rails	**33**@35	.....	.....	36.00	.....

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	$1.45	$1.70
Chicago, (creosoted) (zinc treated)	1.85	2.10
San Francisco..... Green Douglas Fir	.84	1 14
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.25
St. Louis, White Oak, plain	1.25	**1.50**
St. Louis (creosoted) (zinc treated)	1.65	**2.00**
St. Louis, Red Oak, plain	1.15	**1.40**
St. Louis, Sap pine-cypress	1.00	**1.25**
Birmingham, white oak	1.25	1.50

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Oct. 2	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ¾-in. and larger	$1.80	$3.15	$3.65	$3.75	$4.35	$3 72
Track bolts	3.75@**4.00**	4.00	4.65	4.65	5.85	4.57
Standard section angle bars	2.75	2.75	3.40	**3.40**	4.00	3.20

PIPE

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
⅛ to 3	62	50½	1 to 1¼	30	13

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

⅛ to 1¼	60	49½	1 to 1½	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
⅛ to 3 in. butt welded	48%	56%	61%	49%
2½ to 6 in. lap welded	44%	53%	58%	46%

	Galvanized			
	New York	Chicago	Birmingham	St. Louis
⅛ to 3 in. butt welded	34%	43%	50%	36%
2½ to 6 in. lap welded	30%	40%	48%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 34@5% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham Mill	Pittsburgh	New York	
			Oct. 2	One Year Ago
4 in.	$53@54	*$61.60@62.60*	*$61 60@62 60*	$68.60
6 in. and over	50.00	*55.60@56.60*	*56.60@57.60*	63.60

	Chicago	St. Louis	San Francisco
4 in.	$61 20@62 20	*$54.60*	*$60.00*
6 in. and over	56 20@57.20	*50.60*	*56.00*

Gas pipe and Class "A," $5 per ton extra.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

Size, In.	New York Oct. 2	New York One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$45.00	$45.00	**$55.00**	$50.00	.....	*$73.00*
4	55.00	55.00	**55.00**	60.00	$76.50	110.00
5	80.00	80.00		90.00	97.75	118.00
6	105.00	105.00	85.00	100.00	127.50	150.00
8	170.00	170.00	195.00	200.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3		$0.093	$0.105	.....	$0.17	$0.12	.....
4	.....	093	.10	$0.1175	.17	.15	$0.15
5	.....	.1395	.14	.....	.26	.18	.18
6	$0.21	.1395	.165	.1645	.26	.21	.21
8	.36	.217	.265	.26	.41	.30	.325
10	.53	.3255	.385	.364	.61	.42	.476
12	.68	.4185	.46	.468†	.79	.54	.612
15	1.14†	.558	.655	.78†	1.04	.90	1.02
18	1.65†	.775	.70	1.092†	1.45	1.32	1.52
20	2.00†	.93	1.40	.....	1.74	.....	.....
22	2.65†	1.24	1.68	1.456†	2.32	.....	1.564
24	2.97†	1.395	1.75	1.872†	2.61	2.16	2.04
27	4.65†	2.665	2.80	2.75†	3.77†	3.00	3.34
30	5.16†	2.952	....	3.40†	4.18†	3.60	4.06
33	6.98†	3.96	....	4.05†	5.22†	.....	4.99
36	8.00†	4.51	....	4.45†	5.95†	.....	5.42

	3	5	8	12	24	36
Boston	**$0.133**	**$0.215**	**$0.33**	**$0.65**	**$2.12†**	**$6.30†**
Minneapolis	.....	.....	.40	.72	2.55†	5.66†
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	.14	.....	.35	.72†	2.60†	.....
Los Angeles	.1625	.195	.275	.495	1.65	.....
New Orleans	.148*	.207*	.345	.586	1.182	.....
Cincinnati	.111	.1665	.259	.4995	1.665	4.92
Atlanta	.11*	.135*	.225	.3825	1.4625	.....
Montreal	.68‡	.45†	.70	1.35	4.50†	.....
Detroit	.111	.1665	.259	.4995	2.43†	6.15†
Baltimore	*.111*	*.166*	*.259*	*.499*	*1.665*	*4.92*
Kansas City, Mo	.15	.21	.335	.....	.....	.....
Philadelphia	.12	.18	.28	.54	1.80	4 61

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		Oct. 2	One Year Ago
New York, 45% asphalt	(at terminal)	$0.055	$0.053
New York, 65% asphalt	(at terminal)	.06	.052
New York, binder	(at terminal)	.065	.06
New York, flux	(at terminal)	.04	.06
New York, liquid asphalt	(at terminal)	.06	.048
St. Louis, 40@50% asphalt		.0475	.0535
St. Louis, 50@60% asphalt		**.0581**	.0565
Chicago, 40–50% asphalt		.0525	.0525
Chicago, 60–70% asphalt		.055	.055
Dallas, 45% asphalt		.0495	.0495
Dallas, 55% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		11.00*	9.50*

* F.o.b. Oelum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Mexican*)	$19@20*	$15@16
Boston (*Mexican*)	21.00	16.00
Chicago (*Stanolind*)	21.00	15.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	17.00	11.00
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond*	*22.25*	20.50
Denver (*California*)	24.00	....
Minneapolis *f.o.b. Twin Cities* (*Stanolind*)	25.10	19.10
St. Louis (*Mexican*)	23.50	21.50
Baltimore (*Mexican*)	19.00	14@15
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	32.00	28.50
Detroit (*Mexican*)	22.00	18.00
Cincinnati (*Kentucky Rock*)	....	11.65
Maurer, N. J. (*Bermudez*)	28.00	26.00
Maurer, N. J. (*Mexican*)	20.50	17.50
Philadelphia (*Mexican*)	*20.00*	*16.00*
Kansas City (*Texas*)	27.30	22.30
Los Angeles ("*D*" *grade, California*)	20.15	11.00†
Birmingham (*Mexican*)	32.00	28.50

*In drums. †f.o.b. El Segundo Refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	*$135.00* per M.
Chicago	About 4x8x4 dressed	3.60 per sq.yd.
	About 4x8x4 common	2.95 per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	130.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4 x 8 x 4	3.25 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	4x8x4	1.65 per sq.yd.
Kansas City	Granite	3.85 per sq.yd.
Philadelphia	Granite	3.00@4.25 per sq.yd
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft wide	$0.22 per sq.ft.
	Manhattan, 4 ft. wide	.22 per sq.ft.
	Queens, 5 ft wide	.24 per sq ft.
	6x24-in. cross-walk	1.20 per lin.ft.
Chicago	18 in. wide....No market	.... per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5 x 16 in., 85c.; 5 x 20 in., Queens, 95c. *St. Louis*: Class "A" straight, delivered, 5 x 16 in., 90c. per lin.ft.

WOOD BLOCK PAVING—	Size of Block	Treatment	Per Sq.Yd
New York (*delivered*)	3	16	**$2.39**
New York (*delivered*)	3½	16	**2.67**
Boston	3½	18	2.55
Chicago	4	16	3.20
Chicago	3½	16	2.90
St. Louis	3½	16	2.35
St. Louis	4	16	2.65
Seattle	4	16	Off market
Minneapolis	3½	16	2.75
Atlanta	3½	16	2.00
New Orleans	3	16	1.70
New Orleans	3½	16	2.10
New Orleans	4	16	2.50
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	....
Cincinnati	3½	16	2.38
Kansas City	4	16	3.00
Philadelphia	4	16	None used

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In.		Gravel ¾ In.		Sand	
	Oct. 2	One Year Ago	Oct. 2	One Year Ago	Oct. 2	One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.25
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	2.75	2.00	2.75	2.00	2.75	2.00
St. Louis	1.45†	2.30†	1.65†	2.35†	1.18†	2.10†
Seattle	1.50	1.25	1.50	1.25	1.50	1.25
Dallas	2.38	2.38	2.38	2.38	2.00	1.89
Minneapolis	1.85*	1.85*	1.85*	1.85*	1.25	1.25
Cincinnati	1.40†	1.50†	1.40†	1.50†	1.35†	1.30†
San Francisco	2.15	2.15	2.15	2.15	1.50	1.50
Boston	**1.45†**	1.40†	**1.45†**	1.40†	1.00†	1.10†
New Orleans	3.00	2.85	3.00	2.85	1.25	1.25
Los Angeles	0.75*†	2.50†	*0.80*††	2.50†	*0.50*††	1.75†
Atlanta	1.90†	1.85†	1.90†	1.85†	1.40†	1.24†
Detroit	2.02	1.62	2.02	1.62	1.62	2.02†
Baltimore	1.40	1.40	1.60	1.60	0.70†	0.70†
Montreal	1.25†	1.25†	1.25†	1.50†	1.25†	1.25†
Birmingham	2.00	....	2.00	....	1.30†	1.30†
Philadelphia	2.10	2.00†	2.10	2.00†	1.50	1.50
Kansas City	3.20†	1.75	3.20†	1.60	....	0.66*†

New York—Grits, $1.75 per cu. yd.; ready mixed, $2.00

Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.

* At pit. † Per ton.

CRUSHED STONE—Price for cargo or carload lots f.o.b. cars, unless stated otherwise, is as follows, per cu.yd.:

	1½ In.		¾ In.	
	Oct. 2	One Year Ago	Oct. 2	One Year Ago
New York	$1.75	$1.65	$1.85	$1.75
Chicago	2.75	2.00	2.75	2.00
St. Louis	1.75*	1.75	1.75*	2.00
Dallas	2.40	2.38	2.83	1.90
San Francisco	2.15	2.15	2.15	2.38
Boston	**1.50***	1.60*	**1.50***	2.15
Minneapolis	1.75	1.85	1.75	1.60*
Kansas City	1.50	1.50	1.50	2.00
Denver	3.50	3.50	3.50	1.50
Seattle	3.00	3.00	3.00	3.50
Atlanta	2.00*	2.00*	2.00*	3.00
Cincinnati	1.90*	1.65*	1.90*	2.00*
Los Angeles (*at quarry*)	1.15	....	1.00	1.65*
Detroit	1.70	1.75	1.70	....
Baltimore	2.50	2.50	2.55	1.75
Montreal (del.)	2.25*	1.80*	2.25*	2.55
Philadelphia	2.10	2.00*	2.10	1.90*
Pittsburgh	2.85	2.85	2.85	2.00*
Cleveland	3.25*	3.25*	3.25*	2.85
Birmingham	....	....	....	3.25*

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants:

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.40	1.40	2.00	1.40
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa.	0.85	0.90	2.50	....
Birmingham, Ala.	1.00	1.20	2.05	....
Buffalo, N. Y., and Erie, Pa.	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.45	1.45	1.45	1.25
Eastern Pa. and Northern N. J.	1.20	1.20	2.50	1.20
Western Pennsylvania	1.25	1.25	2.00	1.25
Longdale and Glen Wilton, Va.	1.25	1.25	2.50	1.00
Toledo, Ohio	1.50	1.50	1.50	1.50

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$18.20	$13.10	$3.75*	*$2.50@3.00*
Chicago	20.00	18.00	....	1.50†
St. Louis	24.00	20.00	....	2.63*
Boston	**20.50**	**15.50**	**3.95***	**3.25***
Dallas	20.00	....	....	1.85†
Cincinnati	16.80	14.30	....	13.40‡
San Francisco	22.60	....	....	2.15†
Minneapolis	25.50	21.00 (white)	1.70†	1.40†
Denver	24.00	....	....	2.70†
Detroit	22.00	20.00	....	20.00‡
Seattle, *paper sacks*	24.00	.....	2.80†	....
Los Angeles	....	....	18.00‡	2.70†
Baltimore	24.25	17.85	2.55†	....
Montreal	....	21.00	....	10.50‡
Atlanta	22.50	14.00	2.10†	1.45†
New Orleans	24.00	18.00	2.20†	2.20†
Philadelphia	23.00	16.00	....	....
Kansas City	17.75	16.00	2.45*	2.10*
Birmingham	18.00	14.00	2.00†	1.75†

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton—Refund of 10c. per bbl. Minneapolis quotes brown common lump lime; Kelly Is. white is $1.80. Sheboygan $1.70. New York quotes hydrated lime "on cars" in paper sacks, lump lime "alongside dealers docks" or "on cars."

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b. exclusive of bags:

	Oct. 2	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.35	1.75
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.50	2.80
St. Louis (Carney)	2.35	2.35
Birmingham (Magnolia) pozzolan cement	2.10	2.10

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	Oct. 2	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.70@2.80
New York, alongside dock to dealers	2.15	2.15	2.30
Jersey City	2.33	2.33	2.48
Boston	**2.70**	2.64	2.78
Chicago	2.20	2.20	2.20
Pittsburgh	2.19	2.19	2.24
Cleveland	2.39	2.39	2.46
Detroit	2.40	2.40	2.48
Indianapolis	2.41	2.41	2.41
Milwaukee	2.35	2.35	2.37
Duluth	2.19	2.19	2.25
Peoria	2.37	2.37	2.41
Cedar Rapids	2.44	2.44	2.48
Davenport	2.39	2.39	2.43
St. Louis	2.30	2.30	2.45
San Francisco	2.61	2.61	2.63
New Orleans	2.80	2.80	2.90
Minneapolis	2.42	2.42	2.50
Denver	2.84	2.84	2.84
Seattle	2.90	2.90	2.90
Dallas	2.05	2.05	2.25
Atlanta	2.35	2.35	3.00
Cincinnati	2.47	2.47	2.54
Los Angeles	**2.98**	2.83	3.16
Baltimore	2.90	2.90	2.65
Birmingham	2.40	2.40	2.70
Kansas City	2.70	2.70	2.45
Montreal	1.80	1.90	2.25
Philadelphia	2.41	2.41	2.96
St. Paul	2.42	2.42	2.50
Toledo	2.45	2.45	2.48

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.95	Hudson, N. Y.	$2.05
Universal, Pa.	1.95	Leeds, Ala.	1.95
Steelton, Minn.	2.00	Hannibal, Mo.	2.05
Fordwick, Va.	2.05	Lehigh Valley District	1.95
Mitchell, Ind.	2.05	Wyandotte, Mich.	2.15
Iola, Kan.	1.95	Alpena, Mich.	2.10
Mason City, Ia.	2.00	Richard City, Tenn.	2.01
La Salle, Ill.	2.05	Kingsport, Tenn.	2.05

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Warehouse: Pittsburgh Mill	Chicago Mill	New York	St. Louis	Dallas	San Francisco
032	22	$0 95	$1 02	$1 39	$1 04	$1 13	$1 15
049	28	1 20	1 30	1 76	1 32	1 38	1 45
068	35	1 47	1 59	2 16	1 62	1 67	1 78
093	45	1 89	2 04	2 77	2 08	2 00	2 28
126	57	2 34	2 53	3 45	2 59	2 55	2 85
153	68	2 79	3 02	4 11	3 08	3 15	.....
180	78	3 20	3 47	5 70	3 54	3 47	.....
245	103	4 22	4 57	6 21	4 66	4 58	5 94
287	119	4 88	5 28	7 19	5 39	5 26	.....
336	138	5 66	6 13	8 35	6 25	6 11	.....
395	160	6 56	7 10	9 65	7 25	7 12	.....

PAVING

036P	17	$0 72	$0 78	$1 06	$0 79	$0.76	.....
053P	24	1 02	1 10	1 50	1 12	1 07	.....
072P	31	1 29	1 40	1 90	1 42	1 39	.....
097P	40	1 66	1 80	2 45	1 83	1 90	.....
049R	24	....	1 10	....	1 12	1 07	.....
067R	31	....	1 40	....	1 42	1 39	.....
089R	40	....	1 80	....	1 83	1 90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq. ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Weight in pounds	New York	Chicago	St. Louis	San Francisco	Dallas
2.2	$21 00	$19 03	$20 00	$24 00	$23.50
2.5	23 00	21 00	21 00	26 00	25 00
3.0	27 00	24 50	24 50	30 00	28 50
3.4	29 00	26 50	26.50	.....	31 00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Warehouse, Uncut: Pittsburgh Mill	Birmingham	New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger..	*$2.00*@$2.10	....	$3 24	$3 00	$3.10	$3 38	$3 35
⅝	*2.05*@ 2.15	....	3 34	3 10	3 20	3 43	3.45
¾	*2.10*@ 2.20	....	3 44	3 20	3 40	3 48	3 55
⅞	*2.25*@ 2.35	....	3 64	3.40	3.65	3 63	3.75
1	*2.50*@ 2.60	....	4 24	4.00	4 30	3.78	4 35

For size and cutting extras, manufacturers and distributers, see bar card of July 1, 1923.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
½ and larger	$2.70	$3.00	$3 08	⅝	$3.10	$3.20	$3 30
¾ in.	2.80	3 05	3 13	1	3.70	3.50	3.48
⅞	2 90	3.10	3.18		.....	.....	....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Oct. 2	One Month Ago	One Year Ago	Paving Block: 3-inch*	4-inch*
New York (del.)	$17.00	$17.00	$23 65	$44.00†	$51.00†
New York (at dock)	.....	.....	20.00	.....	.....
Chicago	12 00	12 00	11.00	50 00	50 00
St. Louis, salmon	16@18	16@18	16@18	38@40	40@42.50
Denver, salmon	12 00	12 00	12 00	.....	.....
Dallas	*12 10*	14 10	13.10	35.00	.....
San Francisco	15 50	15 50	15.00	.....	.....
Los Angeles	15 00	15 00	15.50	(not used)	
Boston (del.)	22 00	21.00	21 00	45.00†	53.00†
Minneapolis (del.)	14.00	14.00	17@19	.....	.....
Kansas City	16.50	16 50	14 50	(no market)	
Seattle	15 00	15 00	15 00	.....	42.50
Cincinnati	17.00	17.00	17@20	40.00	45.00
Montreal	17 50	17 50	16 50	100.00‡	68 00
Detroit (del.)	17 50	17.50	18.25	38 50	41.50
Baltimore	18.00	18 00	21.00	40.00	45.00
Atlanta	11 00	11 00	11.00	40.00	.....
New Orleans	19 50	19 50	18 75	.....	.....
Birmingham	12 50	12 50	13@15	(no market)	
Philadelphia	19 00	19.00	22.00	38.00	46.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	16.00	16.00	16.00	.....	.....

*For paving blocks 3½x8½x3 and 3½x8½x4 respectively. †F.O.B. ‡Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Oct. 2 on Trucks*	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory*
4x12x12	$0 1162	$0.1179	$0.089	$0.125	$0.077	$0.108	.....
6x12x12	.1743	.1769	.114	.....	.103	.156	.....
8x12x12	.2179	.2211	.163	.215	.14	.244	.....
10x12x12	.....	.....	.21	.....	.17	.....	$0.2786
12x12x12	.....	.....	.25	.....	.21	.....	.3448

*5 per cent off for cash.

	4x12x12	8x12x12	12x12x12
Boston	$0.125	$0.23	.....
Minneapolis (f.o.b. cars)	.073	.12	$0.215
Minneapolis (delivered)	.08	.13	.23
Cincinnati	.07485	.13745	....
Kansas City	.085	.145	....
Denver	.085	.155	.188
Seattle (delivered)	.11	.20	.30
Los Angeles	.085	.172	....
New Orleans	.14	.24	....
Detroit (delivered)	.1044	.1958	.2737
Montreal	.12	.225	.30
Baltimore	.125	.27	.....
Atlanta	.1004	.1674	.....
Dallas	*.0941*	*.1824*	*.265*
Birmingham	.11	.175	.....
Pittsburgh (delivered)	.068	.128	.179
Cleveland	.08	.14	.....

San Francisco and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Warehouse: Birmingham	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in	*$1.90*@*$2.00*		$3.34	*$4.15*	$3 25	$3 10	*$3.00*
Channels, 3 to 15 in.	*1.90*@ *2.00*		3.34	*4.15*	3.25	3 10	*3.00*
Angles, 3 to 16 in., ¼ in. thick	*1.90*@ *2.00*		3.34	*4.15*	3 25	3 10	*3.00*
Tees, 3 in. and larger	*1.90*@ *2.00*		3.34	*4.15*	3.30	3 10	*3.05*
Plates, ¼ in. thick and heavier	*1.60*@ *1.90*		3.34	*4.15*	3 25	3.10	*3.00*

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York Oct. 2	New York One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	$2.60	$3.75	$4.40	$3 50	$3.65	$5.00	*$4.75*

CONE HEAD BOILER

½ in	$2.90	$3.85	$4 50	$3 60	$3.85	$5 20	$5.00
⅝ and ¾	3 05	4.01	4.66	3 70	4.10@4.35	5 35	5.15
⅞ and 1	3.30	4.25	4.90	3.70	4.50	5 60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.80	$3.75	$3 80	$4.10	$4 55	$3.24	$4.95
Cut	2.90	4.25	4.45	5.25	5 00	3.49	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	Black	Seattle Black
½	$8.25	$6.20	$7.75
⅝	7.80	5.80	*5.50*
¾	7.65	5.65	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.64 per roll to consumers in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $6.95 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in l) f.o.b. Philadelphia, l.c.l., $6.05 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to consumers in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$85 73
Tar pitch (in 400-lb. bbl.), per 100 lb	2 13
Asphalt roofing (in barrels), per ton, f.o.b. plant*	40.50
Asphalt felt (light), per ton, f.o.b. plant*	87.75
Asphalt felt (heavy), per ton, f.o.b. plant*	87.75

*Delivered in Metropolitan Dist., $2.00 additional.

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 82 per cent; "A," 86 per cent; "B," 88 per cent. Double thickness "AA," 82 per cent; "A," 85 per cent; "B," 88 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	*$2.60* @ 2.70	$3.90	$3.80	*$3.95*	*$3.89*
No. 12	*2.70*@ 2.80	3.95	4.05	*4.00*	*3.94*
No. 14	*2.80*@ 2.90	4 00	4.10	*4.05*	*3.99*
No. 16	*3.00*@ 3.10	4.10	4.20	*4.15*	*4.09*
Black					
*Nos. 18 and 20	*3.25*@ 3.35	4 45	4.55	*4.80*	*4.40*
*Nos. 22 and 24	*3.30*@ 3.40	4.50	4.55	*4.85*	*4.45*
*No. 26	*3.35*@ 3.45	4 55	4.60	*4.90*	*4.50*
*No. 28	*3.40*@ 3.50	4.65	4.50	*5.00*	*4.60*
Galvanized					
No. 10	*3.50*@ 3.60	4.65	4.60	*4.90*	*4.60*
No. 12	*3.60*@ 3.70	4 75	4.70	*5.00*	*4.70*
No. 14	*3.60* 3.70	4 75	4 70	*5.00*	*4.70*
Nos. 17 to 21	*3.90*@ 4.00	5 05	5.00	*5.30*	*5.00*
Nos. 22 and 24	*4.05*@ 4.15	5 20	5.15	*5.45*	*5.15*
*Nos. 25 and 26	*4.20*@ 4.30	5.35	5.30	*5.60*	*5.30*
*No. 28	*4.50*@ 4.60	5.65	5.50	*5.90*	*6.60*

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: Oct. 2	One Year Ago	Chicago: Oct. 2	One Year Ago
Raw in barrels (5 bbl. lots)	*$1.03*	$0.95	$1.05	$1.14

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry		In Oil	
	Oct. 2	1 Yr. Ago	Oct. 2	1 Yr. Ago
Red	$14.75	$14.00	$16.25	$15.50
White	14.75	14.00	14.75	14.00

LUMBER

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft	10-16-18 and 20 Ft.	22 and 24 Ft	25 to 32 Ft.
3x3 and 4	$28.00	$29.00	$30.00	$35.00
3x6 and 8	28.00	29.00	30.00	35.00
4x4-6 and 8	28.00	29.00	30.00	35.00
3x10 and 12	28.00	29.00	30.00	35.00
3x14	34.00	34.00	36.00	38.00
4x10 and 12	28.00	29.00	30.00	35.00
4x14	34.00	34.00	36.00	38.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$30.00	$32.00	$34.00
6x14	36.00	38.00	40.00
8x10	30.00	32.00	34.00
8x14	36.00	38.00	40.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	*$40.00*	*$41.00*	**$52.00**	**$56.00**
3x10 to 10x10	*45.00*	*46.00*	**53.00**	**56.00**
3x12 to 12x12	*51.00*	*52.00*	**55.00**	**58.00**
3x14 to 14x14	*58.00*	*59.00*	**57.00**	**60.00**
3x16 to 16x16	*67.00*	*68.00*	**64.00**	**65.00**
3x18 to 18x18	.....	.....	**68.00**	**69.00**
4x20 to 20x20	.....	.....	**70.00**	**71.00**

*Wholesale price to dealers; to contractors, delivered from lighters or cars to ob, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12 x 12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under.

Other Cities	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	$56.00	*$53.00†*	*$49.00*	*$49.00*	**$68.00**	**$66.00†**
Seattle	.....	29.50	.....	.....	.....	**26.00**
New Orleans	29.00	.....	.....	.....	39.00	.....
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	40.00	74.00	74.00	88.00	44.00	78.00
Montreal	50.00	58.00	.....	.....	60.00	65.00
Los Angeles	.....	*37.00*	.....	.....	.....	38.00
Denver	.....	**35.75**	**35.75**	**35.75**	.....	34.75
Minneapolis	40.00	37.75	39.00	.....	43.10	37.75
Atlanta	32.00	.....	.....	.....	35.00	.....
Dallas	52.25	.....	.....	.....	57.20	.....
Kansas City	38.25	.....	.....	.....	48.25	.....
Birmingham	20@30	.....	.....	.....	25@33	.....
Philadelphia	*41.00*	*35.00*	41.50	43.00	*51.00*	*36.00*
Detroit	**43.75**	46.75	.....	.....	**50.75**	46.75
St. Louis	42.00	.....	.....	.....	54.00	.....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$45.00	*$43.00†*	*$43.00*	$52.00	*$50.00†*
Seattle	.....	25.00	.....	.....	29.00
New Orleans	67.00	.....	.....	33.00	.....
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	75.00	80.00	75.00	38.00	88.00
Montreal	56.00	50.00	45.00	45.00	45.00
Los Angeles	.....	32.00	.....	.....	37.00
Denver	.....	32.25	32.25	.....	**31.25**
Minneapolis	43.00	**35.75**	35.50	37.00	**32.75**
Atlanta	20.00	.....	.....	30.00	.....
Dallas	52.25	.....	.....	55.73	.....
Kansas City	70.00	.....	.....	75.00	.....
Birmingham	.....	.....	.....	24@42	.....
Philadelphia	29.00	*35.00*	41.00	*41.00*	35.00
Detroit	38.75	35.00	.....	44.00	36.75
St. Louis	41.00	.....	.....	30.00	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M.ft. to contractors.

Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers price to contractors on large projects.

St. Louis—Wholesale price to contractors, f.o.b. cars, $3 per M.ft. additional.

Seattle—Price to contractors, delivered.

Dallas—Wholesale to contractors, $10 per M.ft. additional.

*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

MISCELLANEOUS

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Oct. 2	One Month Ago	One Year Ago
$2.10@2.15	$2.05@2.15	$2.65

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern New York and Missouri River	Territory East of
Plow steel round strand rope	35%	
Special steel round strand rope	30%	
Cast steel round strand rope	20%	
Round strand iron and iron tiller	5%	
Galvanized steel rigging and guy rope	7½%	
Galvanized iron rigging and guy rope	+12½%	

California, Oregon, Nevada and Washington Discount: 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arizona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft., ⅝-in. 6; ¾-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	*$0.16½@.21*	New Orleans	$0.17½
New York	.18½	Los Angeles	.19
Chicago	.18	Seattle	.17
Minneapolis	.19½	St. Louis	.18½
San Francisco	.17	Montreal	.16
Atlanta	**.20**	Detroit	.19
Denver	.19½@.20½	Baltimore	.19
Cincinnati	.21	Kansas City	.20
Dallas	.21	Birmingham	.23
Philadelphia	*.18*		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.23	.25
Kansas City	.2125	.2325
Seattle	.165	.19
Chicago	.22	.25
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2125
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.21	.24
New Orleans	.235	.29
San Francisco	.1625	.1925
Philadelphia	.215	.24

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f. o. b. New York:

Sulphate of aluminum, in bags, per 100 lb.	$1.35@1.40
Sulphate of copper, in bbl., per 100 lb.	*4.50@4.75*
Soda ash, 58%, in bags, per 100 lb.	1.25@1.45
Chlorine, liquid, cylinders, 100 lb., per lb. (f.o.b. works)	.05½@.07½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	*2.20@2.25*

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.58	Kansas City	.735
Boston	.365	New Orleans	.67
Buffalo	.265	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.15*
Cincinnati	.29	Philadelphia	.32
Cleveland	.19	St. Louis	.43
Denver	1.15*	St. Paul	.60

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.